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Editor
MAURICE A. SMITH D.F.C. and BAR

Associate Editor
H. F. KING M.B.E.

Technical Editor
W. T. GUNSTON

Production Editor
ROY CASEY

Iliffe and Sons Ltd
Dorset House
Stamford Street
London, S.E.1
Telephone · Waterloo 3333 (60 lines)

BRANCH OFFICES

Coventry
8-10 Corporation Street
Telephone · Coventry 5210

Birmingham 2
King Edward House, New Street
Telephone · Midland 7191 (7 lines)

Manchester 3
260 Deansgate
Telephone · Blackfriars 4412 (3 lines)
Deansgate 3595 (2 lines)

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Telephone · Central 1265 (2 lines)

Toronto 1, Ontario
Thomas Skinner of Canada, Ltd.
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Aeronautical Paris Fashions

WE have often wondered how justifiable is the word insular when applied to a nation which in the course of centuries has spread the English language and customs over a quarter of the world. But Europeans, and particularly our French allies, sometimes think of us in this way. Yet quite subtly, as commerce and industry on the Continent have approached the boom proportions we witness there today, Britons have come to examine their economy more and more as Europeans. Those who cry Empire! at the mere mention of a common market do not go unheeded, but they do not fully echo the mood of the times. To become more European is not necessarily to become less British.

Last week there was an opportunity for the British aircraft industry, potentially one of the nation's strongest export assets, to measure its progress against that of Europe, and of France in particular. Always in the past we have compared our accomplishments with those of the Americans. Today we would do well more frequently and attentively to divert our eyes from their transatlantic vigil and turn them towards France.

For if we find that the battle for markets is a hard one in the face of American might and resource, we may yet have a surprise or two in store from the talented French industry—even though, in terms of people employed, it is only one-third the size of ours.

The XXIInd Paris Salon was presented with the usual *panache*; but there was more than spectacle at Le Bourget. Nothing in any department of aeronautical endeavour—and our scrutiny of the static exhibition was intentionally more comprehensive than ever before—gave cause for complacency.

Only a few years ago it seemed that the French no sooner had an idea than they had a prototype, be it an aeroplane or an article of equipment. The fecundity of prototypery and "cardboard" exhibits was becoming a joke even in France, and we can think of half-a-dozen aeroplanes which were as brilliant but as transient as butterflies.

The tenor of France's industry is different today. The brilliance is there, but so is realism, and above all there is a determination—not particularly noticeable in the past—to sell in foreign markets.

There were many surprises in the static display, where one could, as it were, look beneath the skins of the advanced aeroplanes displayed outside. We admired the radar, radio and electronics for their high standard of design and fabrication. The freshness and originality of the French approach to common problems was well exhibited in this type of equipment. There was a particularly good hyperbolic navigation system which appeared just what the world's traffic controllers and pilots are crying out for: a system which shows the position of the aircraft to the controllers in the tower, as well as the position of all other aircraft to the pilot in the cockpit. One company claimed to have produced a successful inertial navigation system. And there were excellent powered controls, which again—particularly from the point of view of stability augmentation—exhibited a comprehensive and original approach to the regime of supersonic flight control.

The flying display drove home hard the fact that the French now concede little to anyone in their achievements. There were the Djinn and Alouette, reminders that the French are still the only nation with turbine-powered helicopters in service—and in quantity service—anywhere. And the beautiful Caravelle, now being demonstrated in the flesh to the richest market in the world. This jet transport is being promoted hard by a firm very much awake to the turbojet-conscious mood of American operators. Technically it is outstanding, and its impact on European routes will be keenly felt in 1958 by Air France's competitors. The Caravelle is a specialized short-haul jet transport which will present a challenge of its own, and it will not be seriously threatened until the elusive "new plateau" short-haul jet of the mid-sixties is realized. And there was demonstrated a machine which seemed more than any other to enshrine the vigour, challenge and purpose of France's industry—the truly brilliant Atar Volant.

FROM ALL QUARTERS

World's Absolute Altitude Record

THE world's official absolute altitude record was broken last Sunday, June 2, by a balloon piloted by Capt. J. W. Kittinger, U.S.A.F. Ascending from St. Paul, Minnesota, he reached a height of 96,000ft (over 18 miles). Subject to confirmation of the new figure by the Fédération Aéronautique Internationale—assuming it to be submitted for homologation—this handsomely exceeds the 72,395ft record which has stood ever since November 11, 1935, to the credit of two other American balloon pilots, Captain Orvil A. Anderson and Capt. Albert W. Stevens.

Kittinger made the ascent in 1 hr 20 min and returned to earth 80 miles away 6 hr 34 min after take-off. He spent 1 hr 50 min at maximum altitude. The plastic envelope of the balloon contained some two million cubic feet of helium, and the pilot rode in a light-alloy cylindrical capsule, elaborately air-conditioned, only 3ft in diameter.

The ascent is a preliminary to others in the near future; Capt. Kittinger intends to try an even higher ascent, and Maj. David Simmons, U.S.A.F., is to attempt a 24-hour endurance flight at over 100,000ft.

Manned heavier-than-air craft, rocket-powered and launched from a mother aircraft, have, of course, exceeded such altitudes, but these ascents have not been admissible as absolute records under F.A.I. requirements. Some 126,000ft is the figure claimed for the Bell X-2, and already there is apparently well-founded speculation about 580,000ft ascents (over 100 miles) planned for realization within the next eighteen months.

Short's First Britannia Flies

THE first Bristol Britannia to issue from the "second-source" production line of Short Brothers and Harland made its maiden flight from Sydenham Airport, Belfast, on June 1. The event was the culmination of four years' work since Bristol decided, in 1953, to establish a second Britannia line. Appropriately, the Britannia concerned was the first 305 for Northeast Airlines, whose order for five aircraft was placed largely on the strength of the early delivery-date.

The aircraft was immediately ferried to Filton (by Bristol pilot Ken Ashley, who had also made the maiden flight) where C.A.A. certification-flying will be done, and where the special interior—which promises to be the most stylish ever ordered for a production airliner—will be installed. Delivery is due in the autumn, when the aircraft will be put into service on the holiday-run from Boston and New York to Miami.

Shorts have ten more Britannias in an advanced state: so far they have contracted to build 25 of the 66 aircraft now on order.

551 M.P.H. was the winning average speed for this B-47E in the 1957 General Electric Trophy race, held on May 26 over the closed course London-Paris-Madrid-Rome-Paris (2,346 miles). From the left: Capt. Robert E. Sheridan (pilot); 1st Lt. J. L. Mombria (co-pilot); Capt. F. R. Beadle (observer); and Sgt. E. W. Smith (crew chief, i.e., head of the ground crew). Three B-47s comprised the field

FIRST FROM BELFAST: The first Bristol Britannia off Short Brothers' production line—a 305 for Northeast Airlines—seen making its maiden flight last Saturday, June 1 (news item in col. 1).

Sir Arnold Hall R.Ae.S. President

PRESIDENT-ELECT of the Royal Aeronautical Society for 1958-59 is Sir Arnold A. Hall, M.A., F.R.S., F.R.Ae.S., vice-president of the Society and technical director of the Hawker Siddeley Group. He will take office in May 1958.

Vice-presidents of the Society have been elected as follows: P. G. Masefield, M.A., Hon.F.I.A.S., F.R.Ae.S.; E. S. Moult, Ph.D., B.Sc., M.I.Mech.E., F.R.Ae.S.; Air Marshal Sir Owen Jones, K.B.E., C.B., A.F.C., B.A., D.I.C., M.I.Mech.E., F.R.Ae.S.

Britain's Megaton Weapon

ON Friday, May 31, the most powerful British atomic device, with a megaton yield, was exploded over the central Pacific. Previously we had detonated a kiloton fission charge aboard the frigate *Plym* at Monte Bello, an under-water device in the same area, and we air-dropped a less-powerful hydrogen weapon on May 15 last.

Known as *Operation Grapple*, the current series of tests is based on Christmas Island, some 4,000 miles from Japan, 3,000 miles from New Zealand and the American Pacific Coast and 1,200 miles south of the Hawaiian Islands. The area was surveyed in 1955 by Shackletons of 240 Sqn., and a British Service group laid runways of 6,500 and 5,000ft, together with dispersals, hardstandings and maintenance areas.

Communications were maintained by Dakotas. Rescue services were assigned to Whirlwinds, and Shackletons of 206 Sqn. (W/C. J. E. Preston, St. Eval) and 240 Sqn. (W/C. C. R. Alexander, Ballykelly) were engaged in weeks of long-range ocean patrol to prevent shipping from straying into the restricted area (they carried eight-language warning leaflets). Meanwhile Valiants of 49 Sqn. (W/C. K. G. Hubbard, Wittering) had worked up with dummy weapons on British ranges and finally flew out to the Pacific.

By April 1957 the R.A.F. had 1,300 men on the island; the Army and Marines were also heavily involved and over 2,000 personnel of the Royal Navy were engaged in tasks afloat.

Ground-zero for the megaton bursts was actually some 400 miles south of Christmas Island, in the vicinity of Malden Island (which was fully instrumented). The carrier *Warrior* was the target-area control and aircraft-direction ship, and a large fleet of other vessels were present. Task-force commander, at Christmas, was A. V-M. W. E. Oulton; scientific director was Mr. W. R. J. Cook, Deputy Director of the A.W.R.E., Aldermaston.

Final clearance for the high-yield drop came early on the morning of May 31. The Valiant, already armed with its load, took off at 0830 local time, with the following crew: captain, S/L. David Roberts; co-pilot, F/O. M. A. Pringle; bomb-aimer, F/L. K. Ll. Lewis; navigator, F/L. T. E. Dunne; and air electronics officer, F/O. T. W. Beattie. After making numerous practice or procedure runs in the target area, S/L. Roberts completed a last long circuit, taking 17 min at 600 m.p.h. and finally put the

***COMRADES IN ARMS:** On p. 781 we give an account of the recent NATO photo-recce contest for the Gruenther Trophy. Here, from nearest to farthest, are four NATO P.R. machines: Canberra P.R.7 (R.A.F., 2nd T.A.F.), RF-84F (Netherlands), RF-84F (Belgium) and Swift F.R.5 (R.A.F., 2nd T.A.F.).*

Valiant into a programmed slight dive to the point of release.

Precisely at the moment of release the Valiant pulled round in a maximum-rate turn, with almost 90-deg bank, and departed at full power on a reciprocal heading—a procedure, long practised, which differs somewhat from that of the U.S.A.F. Fifty seconds later, with the Valiant almost ten miles away, the bomb was triggered at a height of more than 10,000ft. The device was reported to have been a 10ft-diameter cylinder, weighing four long tons. Its yield has been estimated unofficially as five megatons, making it the most powerful bomb dropped by any aircraft in the Western world.

All instrumentation worked perfectly and there was no fall-out. Large groups of Shackletons and Canberra samplers, the latter from 76 Sqn. (S/L. G. Bates) and 100 Sqn. (S/L. R. A. McPhie) penetrated the cloud at all levels, and samples were in Britain 29 hours later. So successful was the test that an even more powerful device is likely to follow. In particular, it is now known that Valiants can drop the most powerful hydrogen bombs and get away safely.

Prof. Duncan New A.R.C. Chairman

THE Minister of Supply has appointed Professor William Jolly Duncan, C.B.E., D.Sc., F.R.S., F.R.Ae.S., M.I.Mech.E., Mechan Professor of Aeronautics and Fluid Mechanics in the University of Glasgow, to be chairman of the Aeronautical Research Council.

Professor Duncan succeeds Sir Alfred Grenville Pugsley, O.B.E., D.Sc., F.R.S., F.R.Ae.S., M.I.C.E., M.I.Struct.E., A.M.Am.Soc.C.E., Professor of Civil Engineering in the University of Bristol, who has been chairman for the last five years.

Eight-nation Aeronautical Congress

FOLLOWING preliminary discussions in New York last January, steps were taken in Paris last week to form an eight-nation organization under the title of Congrès International des Sciences Aéronautiques. Its first meeting will be held next summer.

The provisional council, under the presidency of Dr. Th. von Kármán, has set up an executive committee which has elected M. Maurice Roy (who, with M. Jules Jarry, will represent France) as the chairman.

A Notable Gliding Week

LAST week's excellent gliding weather caused many enthusiasts to desert their London offices and head for Lasham and Dunstable. By the end of the week, a number of new United Kingdom gliding records had been reported; those known to the British Gliding Association as we go to press are as given below (all are subject to confirmation).

Monday, May 27, was the most spectacular day. Mrs. Rika Harwood (Olympia) flew from Lasham to Yeovil at a speed of 51 m.p.h., setting up a new women's 100 km speed record; and Dr. Brennig James and Kenneth O'Reilly, in a Gull II, covered the 73 miles from Lasham to Yeovil in 73 minutes—a two-seater, 100 km speed record. William Tonkyn (Kite II) and Aylett Moore (Skylark II) both flew from Lasham to Perranporth (191 miles) at speeds of 47.5 m.p.h. and 58 m.p.h. respectively, and a new distance record of 268 miles was claimed by John Hulme for a Skylark II flight from Cambridge to Truro. Although not official records, flights from Cambridge to Oxford at speeds of 60 m.p.h. and 48 m.p.h. respectively had been made by Peter Nielson (Skylark II) and Siegfried Neumann (Olympia) on the previous day, May 26.

A 100 km triangle, Lasham-Highclere-Kimbridge-Lasham, was flown at 35 m.p.h. on Friday, May 31, by Dr. James and David Marshall in the Gull II two-seater. The following day Col. Anthony Deane-Drummond flew the record out-and-return distance of 190 miles between Lasham and Kidderminster in a Skylark 3, and on Sunday, June 2, achieved 38 m.p.h. over a 200 km triangle, Lasham-Shaftesbury (Dorset)-Grove Aerodrome (near Wantage)-Lasham. This same triangular course was almost completed on the same day by David Ince, also flying a Skylark 3, who landed only one mile short of Lasham after averaging 40 m.p.h.

Whit-weekend Events

TWO public air displays organized by the Soldiers', Sailors' and Airmen's Families Association, and the first Royal Aero Club Aerobatic Competition, are among the U.K. aviation events planned for Whit weekend, June 8-10. Fixtures elsewhere include the sixth international air display of the Royal Netherlands Aero Club, and the annual display at Weston, near Dublin.

The two S.S.A.F.A. displays will be held at Squires Gate, Blackpool, and R.A.F. Station Woodvale, near Southport, on Whit Monday. The same participants will appear at both occasions; they include the Hunter team from North Weald, Provosts from C.F.S., members of the British Parachute Club, and a procession of vintage aircraft. Both displays begin at 2 p.m.; admission is 2s 6d (children 1s).

The Royal Aero Club Aerobatic Competition, to be held at White Waltham on Monday, June 10, is in effect a private meeting, according to the Royal Aero Club, and no arrangements have been made for the general public. The contest will be an all-Tiger-Moth affair with an entry of nine.

No fewer than 70 types and variants of aircraft are scheduled to appear at the Dutch display at Ypenburg, also on Whit Monday. These come from Belgium, Canada, Denmark, Germany, Finland, France, Britain, Italy, the Netherlands, Czechoslovakia and the U.S.A., and range in chronology from the earliest machines of this century to the North American F-100s of the Skyblazers team.

Among the other Whitsun events are the annual display at Weston, near Dublin, organized by the Leinster Aero Club, on Sunday and Monday; and the British National Model Aircraft Championships at R.A.F. Waterbeach, also on Sunday and Monday.

Improved V-Bombers

IN a written reply in the House of Commons on May 28 the Minister of Supply, Mr. Aubrey Jones, gave the first official details of the improved models of the Vulcan and Victor medium bombers—the last manned bombers for the R.A.F.

The Handley Page Victor B.2 will be powered by four Rolls-Royce Conway RCo.11 by-pass turbojets; the Avro Vulcan B.2 will have four Bristol Olympus BOl.6 turbojets. These engines are very much more powerful than the powerplants fitted to the Mk 1 versions of the aircraft, and it may be expected that the airframes of the new machines will be considerably redesigned in order to reap the fullest benefit of the increased power. The original prototype Vulcan flew on August 30, 1952, and the first Victor flew on December 24 of the same year. Some dozens of both types have now been made and both will soon be passing into service with Bomber Command.

The Minister's announcement is unique in that it is the first time in recent years that the exact type of engine fitted to an advanced military aeroplane has been officially revealed. The rated thrust of the BOl.6 is 16,000 lb (a figure which has been appreciably exceeded during development running) and that of the RCo.11 may be assumed to be 17,250 lb, a rating revealed at the Paris Salon for "a military Conway." Rolls-Royce's chief executive, Mr. J. D. Pearson, commented last week that the Ministry of Supply ordered the military Conway more than twelve months ago.

Both these fine powerplants have good commercial prospects.

[*Continued overleaf*

K.L.M.'s VISCOUNT 803—of which this is the first air-to-air picture —is about to be delivered to Schiphol. This is the second 800-series Viscount to be exported; the first, EI-AJI, "St. Gaul," was delivered to Aer Lingus on May 22.

FROM ALL QUARTERS . . .

The Olympus 510 series is a 16,000 lb-thrust engine suitable for the largest types of current jet transport, and already almost completely developed except for endurance-flying. With Bristol's co-operation, Curtiss-Wright in America are developing a similar engine, designated TJ38, derated to 12,500 lb (to give long life and quietness) with the extremely competitive s.f.c. of 0.718. The Conway RCo.10 is a 16,000 lb-thrust commercial engine first ordered by T.C.A. for the DC-8 (delivery March 1960) and for jet transports of Air-India, Lufthansa and B.O.A.C., the last-named operator having ordered 50 aircraft each powered by four RCo.10s.

Quarles on Russia

ASKING for restoration of half the £923m cut in the U.S. defence budget, Mr. Donald Quarles, the Deputy Defense Secretary, expressed concern at Russia's rapid build-up of modern weapons.

The following are extracts from his statement, which was made on a TV programme from Washington D.C.: Jet fighters—"the Russians have larger numbers. Qualitatively I would say we still are somewhat in front, although our lead today is somewhat less than it was three or four years ago"; jet bombers—"they are ahead quantitatively and qualitatively"; submarines—"they are ahead quantitatively, we lead qualitatively"; atomic weapons—"I feel we have a pretty good position there"; missiles—"on the whole I would say we are ahead, although I cannot say we are ahead in all of them."

Mr. Quarles conceded that the Soviet Union was probably ahead with the IRBM (1,500-mile-range missile); regarding the ICBM he said he was "quite confident in my own mind that we won't be beaten."

New U.S.A.F.-Lockheed Contract

A CONTRACT worth £1½m has been awarded by the U.S.A.F. Air Materiel Command to the Lockheed Aircraft Corporation for the completion of "laboratories and other nuclear facilities" at Lockheed's experimental installation in Georgia, where construction began a year ago in connection with a U.S.A.F. research project.

Recently Mr. Robert E. Gross, Lockheed chairman, said that his company could build a nuclear-powered aircraft "within three years" if the Government were to give the "go-ahead signal." The new contract brings the total allocated by the U.S.A.F. to the Georgia facility to £4½m.

U.S.A.F. General Post

DURING recent weeks long-awaited changes in the top structure of the U.S. Air Force have been announced and several high-ranking officers have been reassigned. The following are the more important changes:

New posts, with previous positions in parenthesis: Lt-Gen. Thomas S. Power, elevated to full general and given command of Strategic Air Command (previously Commander, Air Research and Development Command); Gen. Curtis LeMay, vice-chief of Staff, U.S.A.F. (Commander, Strategic Air Command); Lt-Gen. Frank H. Everest, Commander, U.S.A.F. Europe, with promotion to full general (Deputy Chief of Staff, Operations, and previously Commander, Air Force Flight Test Center at Edwards); Lt-Gen. William H. Tunner, Deputy Chief of Staff, Operations, in the Pentagon (Commander, U.S.A.F.E.); Lt-Gen. Samuel E. Anderson, Commander, Air Research and Development Command (Director, Weapons System Evaluation Group, Office of Defense Secretary); Maj-Gen. William E. Hall, Commander, Continental Air Command and senior A.F. member, Military Staff Committee, U.N. (A.C.O.S., Reserve Forces); Maj-Gen. Walter E. Todd, C.O.S., U.N. Command, Korea (vice-cmdr. and C.O.S., F.E.A.F.); Maj-Gen. John K. Gerhart, D.C.O.S., Plans and Programs (Commander 12th A.F., Europe); Lt-Gen. M. M. J. Asensio, Comptroller (D.C.O.S., Comptroller); Maj-Gen. Robert B. Landry, asst. deputy C.O.S., personnel, replacing Maj-Gen. William S. Stone.

It may be remembered that, upon the retirement of Gen. Nathan F. Twining a few weeks ago, Gen. Thomas Dresser White was appointed Chief of Staff, U.S. Air Force.

DAY AND NIGHT in Sycamore Canyon, north-east of San Diego, California—two of the first official photographs of the static-test tower which Convair use for system-checks and short-period engine runs of their intercontinental ballistic missile Atlas. This is one of three Atlas test facilities: engine runs are conducted at Edwards Air Force Base, California; component tests are made at Point Loma, San Diego; and actual launchings—the first of which is due as these words are written—will be from Patrick A.F.B.

THE INFLATOPLANE built by Goodyear for the U.S. Office of Naval Research (see news item, "New pneumatic," below).

HERE AND THERE

Sabre Exchange

OFFICERS of the Norwegian Air Force are to visit Holland between June 9-12 to exchange views on Sabre flying with members of the Netherlands Air Force. Both countries put F-86D Sabre interceptors into service last year.

No Handicap

FLYING a Chipmunk, the legless Australian pilot, Roger Pitt, won maximum points in an inter-state flying-skill competition at Parafield, South Australia.

Silent Service

INVITED by the Boeing Airplane Company to form a noise-study group, Professor E. J. Richards, head of the Aeronautical Engineering Department at Southampton University, leaves for a three-month visit to the U.S.A. on July 4.

Out and Down

THE B.B.C. Light Programme feature *Out and About* will visit the British Parachute Club at Fairoaks tomorrow, Saturday, June 8. Raymond Baxter, who is an ex-R.A.F. pilot, will talk to parachute instructor James Basnett, who will later—with the aid of a miniature transmitter—give a running commentary during a drop from an aircraft at 1,500ft. The broadcasts are at 2.25 and 2.50 p.m.

Hellcat Chase

LAST week a Grumman F6F Hellcat drone, one of several hundred radio-controlled target aircraft used by the U.S. Navy, failed to respond to radio control during a flight from the Naval Ordnance Testing Station at China Lake, Cal. Diving through thunderclouds, it eluded its "chase planes," and headed north at 20,000ft across Oregon. The Air National Guard sent up F-89 Scorpions from Boise, Idaho, and the F6F was finally intercepted by Sabres, crashing south of Spokane, Wash.

New Pneumatic

OUR recent description (in the issue of May 31) of the M.L. Utility aircraft lends additional interest to the news that the new version of the Goodyear Inflatoplane—pictured above—made its first public demonstration flight on May 28 at Olathe, Kansas. Mr. Richard Ulm, the Goodyear pilot, flew in a severe thunderstorm. The wing, tail unit and cockpit enclosure are made of Airmat, a Goodyear product consisting of two walls of rubberized fabric connected by nylon threads, while the fuselage is of single-layer rubberized fabric. Powered by a 44 h.p. Nelson engine, the aircraft (which can be packed into a cabin trunk when deflated) weighs about 200 lb and has a top speed of 60 m.p.h.

C. of M.

ENTERED, for the first time, in the 1957 House Journal Competition of the British Association of Industrial Editors, the *Handley Page Bulletin* was awarded a certificate of merit; 266 journals competed.

Col. Stapp Honoured

FAMED for his rocket-sled deceleration experiments, Col. John P. Stapp, U.S.A.F., has been awarded the Liljencrantz Medal by the U.S. Aero Medical Association. Presented by the Pfizer Laboratories, the award commemorates the late Cdr. Eric Liljencrantz, who died in a flying accident in 1942 when chief of the Medical Research Division of the U.S. Navy Bureau of Medicine and Surgery. Col. Stapp's investigation of the physiological effects of extreme decelerations have included a 40g pull-up from 632 m.p.h. in 1.4 sec.

Golfing Success

WINNER of the *Flight* Challenge Trophy of the Aero Golfing Society for 1957 is Mr. R. L. Lickley, technical director of the Fairey Aviation Company. His score was 67 net (calculated as 76 minus 9); runner-up was Mr. G. A. V. Tyson (83 minus 12). In the captains' ties Mr. Lickley was triumphant in partnership with R. T. L. Rogers (44 pts); the decision was reached after a tie with S/L. J. B. Starkey and S/L. G. K. N. Lloyd.

REGULUS 2: this canard missile is one of Chance Vought's two Mach 1.7 projects, the other being the Crusader ("Flight," May 24). Both are in production for the U.S. Navy, the Regulus being a multi-purpose bombardment missile powered by a G.E. J79 engine (Wright J65 in the wheeled test vehicles shown here). Formating on Regulus in the upper picture are a DT-33 and FJ-3.

EVALUATING DECTRA

Successful Preliminary Trials with Valiant on Transatlantic route

AT 1.30 p.m. on Saturday, May 25th, an R.A.F. Valiant operating for the Ministry of Supply landed at A. and A.E.E., Boscombe Down, after completing the first stage in the current evaluation programme of the Dectra trans-ocean navaid. This system (*Flight*, April 12 and 19) has been developed by the Decca Navigator Co., Ltd., in conjunction with the Ministry of Transport and Civil Aviation and the M.o.S. as a long-range aid; and it is being tested on the North Atlantic because that crossing presents some of the most pressing problems from the point of view of air navigation and traffic control. Owing to the present lack of accurate navigational facilities over that route and its associated diversion areas, A.T.C. is forced to impose separation standards which, with the growing volume of transatlantic traffic, subject aircraft to frequent and costly delays; Dectra, by means of a pair of transmitting stations at Gander and a pair at Prestwick, is designed to lay down tracking and ranging patterns across the Atlantic of such accuracy that close lateral and longitudinal separation standards can be established.

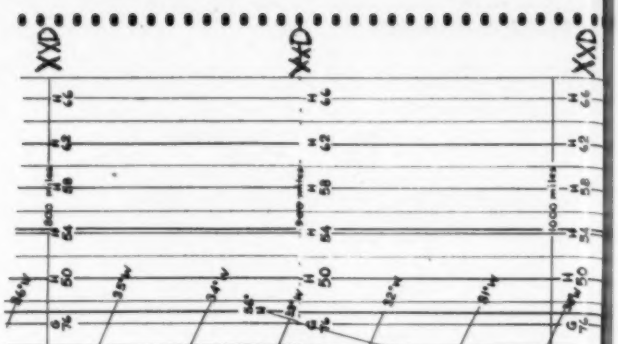
The potentialities of an aid of this type extend, of course, beyond the solution of the A.T.C. problem: throughout the flight the pilot has continuous position-information displayed on the familiar Flight Log, so that he can immediately detect any wind changes and accurately forecast E.T.A.s. Furthermore, in the event of the need to divert, the course and distance to the diversion point—e.g., Iceland or the Azores—are at once indicated.

The initial stage of the present trials was conducted in two phases, the first having taken the form of a flight Boscombe—Gander—Boscombe using conventional navigational methods. Two navigators were engaged during the flight in accumulating all the available positional information against which to assess the accuracy of the Dectra "tracking" pattern produced by the Gander transmitters. So high was the position-line accuracy of the pattern, which was received without interruption during the west- and east-bound flights, that it was decided to proceed forthwith to the next stage of evaluation.

This stage involved using the Dectra and standard Decca systems, in combination, as the primary navigational aid on a second return flight. In the absence of the "ranging" pattern, which will be produced by one of the Prestwick stations in conjunction with one at Gander, the second Flight Log co-ordinate was supplied mechanically from ranging data derived by other means. While an important feature of Dectra is that the airborne equipment is common to both systems, two receivers were installed for test purposes so that the accuracy of the Dectra position lines might be checked against standard Decca fixes in suitable coverage areas; one receiver was therefore switched permanently to Decca and the other to Dectra. The Flight Log could be switched to either set at will. To simulate the procedure envisaged for commercial operation, the high-precision navigational information from standard Decca, displayed on the Flight Log, was used by the pilot for the first 200 miles of the flight. This took the aircraft on a rhumb-line track from Boscombe Down, intercepting the great Circle Track from Prestwick to Gander. Had the aircraft taken the most direct route it would have passed out of range of Loran and other existing services which were required for monitoring purposes in the absence of more accurate checks.

As the Valiant crossed the West coast of Ireland the Flight Log was switched to Dectra and the aircraft flown to reach the designated trans-ocean track pre-drawn on the chart. Thereafter the Valiant was piloted on this track until within range of the local radar aids at Gander. A remarkable feature of the flight was that from the moment of take-off until reaching the Gander radar coverage, the pilot steered solely by reference to the Gander Log; at no time during the out-bound (or homeward) flights did the human navigator give the pilot a course to steer.

On the return flight to the United Kingdom the same procedure was adopted, the aircraft getting the position check from Gander radar and then setting course on the Flight Log and navigating by it until the Irish coast was reached. For the last stage of the return flight the pilot again flew on standard Decca and made a let-down into the circuit at Boscombe Down with its aid. Part of the Flight Log record of the homeward flight is shown here.



Part of the Dectra Flight Log record (about one-half actual size) of the Valiant's track. The distance-gone marks indicate that the section shown is about 200 miles long, centred on a point 900 miles from Gander. The deviation from the prescribed line at 31 deg W represents an off-track distance of about 1½ miles.

The captain of the aircraft was Lt-Cdr. W. Stuart, and Mr. W. Poulter was observer for the Decca Navigator Company.

Much remains to be done in analysing the data recorded (the Dectra meters were photographed every 15 seconds); but even at this early stage a glance at the recorded track suggests that the accuracy of this system will permit a drastic reduction of the present separation standards on the North Atlantic crossing. The flights also mark the practical introduction of a new concept in air navigation—the complete integration of a medium- and a long-range radio navaid in a single airborne installation.

AVRO HONEYCOMB

IT has long been known that A. V. Roe and Co., Ltd., have a tremendous background of experience in the development and production of advanced types of bonded-metal honeycomb for airframe purposes. A considerable proportion of the airframe of the Vulcan uses such material, and the complete tail-end and empenage of the Avro 720 (mixed-power intercepter), recently on view at an Aero Research, Ltd., symposium, was seen to be almost entirely of honeycomb construction.

Avro are now in large-scale production upon several types of honeycomb radar aerial, including large scanner reflectors for ground applications. The use of honeycomb sandwich simplifies the design and increases dimensional stability under load and so improves aerial performance and can even eliminate corrections for signal variation.

In a recent statement Mr. J. A. R. Kay, Avro director and general manager, said "Avro are the largest producers of honeycomb core in Europe, and the great strides made in its development puts the company in a strong position to corner the world's markets in this particular field. It may also give British industry its biggest boost for years." A newly developed machine can produce 1,200 sq ft of core per hour compared with 6 sq ft by older methods. Avro have perfected a machine for checking bonding of the core over the entire surface, and many other machines to speed production have been designed, built and tested at Manchester.

More about Bristol's Low-speed Tunnel

Features of a Works-built Installation

ILLUSTRATED on this page is the interior of the new low-speed wind tunnel of Bristol Aircraft, Ltd., which, as reported in *Flight* last week, was opened on May 24 by Mr. Aubrey Jones, Minister of Supply.

The speed range of the tunnel is 100 to 300ft/sec. As indicated by the plan below, the installation is of the single closed-circuit type. Immediately downstream of the working section (which measures 12ft wide × 10ft high × 25ft long) the first diffuser has an expansion rate equivalent to a cone angle of five degrees. The area of the fan disc is 315 sq ft, and the largest cross-sectional area of the tunnel, just upstream of the contraction, is 745 sq ft.

The contraction ratio is 6.65 : 1, and the contraction section is 30ft long, compared with a 400ft expansion length. A calculated form for the contraction section was checked by means of a model in an electrolytic tank.

Stated to be the world's largest wind-tunnel of mainly wooden construction, the new installation has inner and outer skins carried on a framework of wood and steel. Hoops made from rolled-steel I-sections or back-to-back channel sections and placed at intervals of 11ft form the main ribs of the structure. Between these steel rings, wooden longerons are spaced at 2ft intervals and these in turn are joined by smaller wooden ribs running circumferentially and again arranged at 2ft intervals. This divides the whole framework into boxes 2ft square on the inside and 2ft by approximately 4ft on the outside. The tunnel is lined with half-inch resin-bonded, gaboon-faced plywood, painted in the working section and varnished elsewhere. Externally the whole structure is covered with chipboard and finished with a waterproofing compound.

A narrow slot runs circumferentially round the tunnel at the end of the working section to permit the latter to "breathe." Two gauze screens at the beginning of the contraction section assist in straightening the airflow, and steel-wire guards immediately before the first corner after the working section serve to arrest any loose object blown adrift from the working section.

The fan nacelle is 56ft long and the fan itself is 22ft in diameter. The seven fixed-pitch blades, each with a chord of a little over 2ft, are made of laminated mahogany covered with acetate sheet. Blade tips are square and extend into a balsa-lined gully 2½in deep running round the periphery of the duct at the plane of the fan, so that any small solid object reaching the fan would be unlikely to jam between the blade tip and the tunnel wall.

Like the balance mechanism, the fan is isolated from neighbouring structures and supported on separate foundations. Air approaching the fan passes through a set of six static vanes which impart a swirl contrary in rotation to that of the fan. Beyond the seven-bladed fan another set of six straightener vanes removes any rotation induced into the airstream. The number of vanes in the fan and in the static blades is dissimilar in order to avoid the pronounced "beat" which would occur if all the fan blades were to align simultaneously with the static vanes.

Power is provided by one 850 h.p. A.C. motor and two 550 h.p. D.C. motors, giving a total available horsepower of 1,950; designed power is 1,850 h.p. Fan speed is automatically controlled through the D.C. motors in response to the pressure-difference across the contraction section, the values being measured by pressure tappings at each end of the section and recorded by an automanometer.

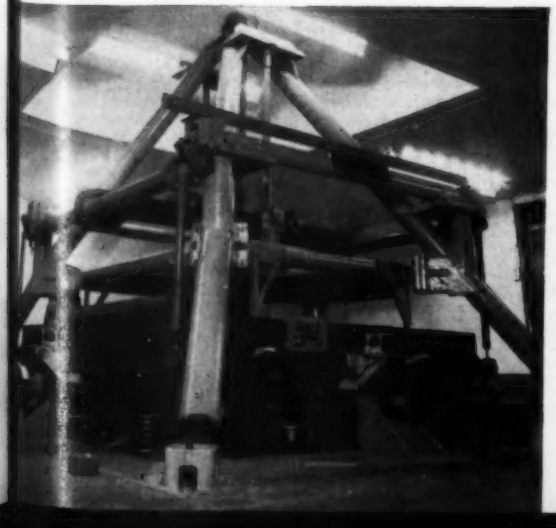
The 22ft-diameter fan and its straightener-vanes.

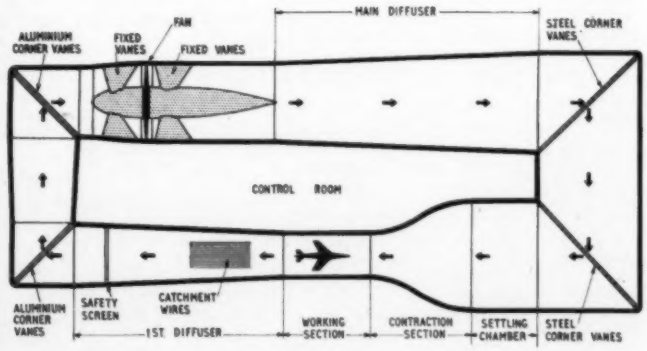
A drop-side door in the working section opens directly into the rigging room, beyond which, and on the same level, is the model-construction workshop.

Forces generated are measured along three axes by a mechanically operated, simultaneous, six-component, virtual-centre balance, and the observations taken by three operators at the console. Movable weights on the weighbeams of the balance can be adjusted electrically from the console to enable the beams to be set to zero at the beginning of a run and at the pre-selected test conditions. Later, this adjustment will be made automatically.

The balance mechanism, claimed to be one of the most sensitive wind-tunnel balances yet designed, is contained in a heat-controlled box maintained at a temperature of 80 deg F with a maximum variation not greater than one degree each way. To reduce vibration to a minimum, it is isolated from the surrounding structures and is supported on separate foundations. [*cont. overleaf*

(Left) Massive but sensitive: the balance mechanism, housed in a temperature-controlled chamber. (Right) General layout of the tunnel.





(Above) The control console. (Right) An aerofoil mounted in the working section. Powerful floodlighting from above and below assists observation and photography.

BRISTOL'S LOW-SPEED TUNNEL . . .

Balance readings, pressure and temperature data and a record of the model attitude are punched on cards and passed hourly to the company's own English Electric Deuce Computer for analysis. Ultimately a permanent landline will feed data direct from the tunnel to the Bristol mathematical services group. Two liquid manometers, of 100 tubes each, are installed for plotting pressure distributions, and flow visualization is normally by means of tufting and oil-film techniques.

All wind-tunnel staff—including those of the other Bristol tunnels—are accommodated in the building, which has its own drawing office, instrument laboratory and reference library.

Completed in December last year, the whole installation was designed and built by the Bristol company—the tunnel itself by the wind-tunnel department in collaboration with the works engineers, while the office block and tunnel foundations were the responsibility of the architect's departments.

AMERICAN ENGINES

THE following is a condensed digest of news of recent aero engines under development in the United States for contrasting applications.

T64: A completely new shaft-drive, free-turbine by General Electric (Navy financed). Rated at 2,600 s.h.p., it has variable stators, high pressure-ratio, a power/weight ratio of three to one and a specific of about 0.4. Under development for fixed- and rotating-wing machines against a contract valued at the very large sum of $58.5m.

J89: Allison turbojet rated at 25,000 lb. High-pressure engine, developed as prototype against Air Force and Navy funds; unlikely to continue, although visualized as leading to an advanced "zip-fuel" engine.

X-48 (provisional designation). Advanced turbojet project by General Electric for use with hydrocarbon or high-energy fuels. Probably to be about 24,000 lb thrust for Boeing or North American bomber (WS-110) or Northrop or North American long-range intercepter (WS-202A).

J58: Pratt and Whitney turbojet of some 22,500 lb thrust. Intensive development for Navy at company's new site at West Palm Beach.

WTF-10: Turbofan (by-pass turbojet) being developed, probably by G.E., against a $2.2m Air Force contract.

THE NEW "INTERAVIA" DIRECTORY

WHEN a none-too-bright American had been given the London telephone directory to read while waiting for an appointment, someone jocularly asked him what he thought of it. "Waal," he replied cogitatively, "there's not much of a plot. But gee, it's a magnificent cast!"

Much the same might be said of the new *Interavia ABC Directory of World Aviation,** which with this 1957 (fifth) edition gets back into its pre-war rhythm of publication once a year; for it is indeed an impressive volume with a "cast" of thousands.

This year 5,000 new listings and 10,000 new names have been added, together with a completely new section—believed to be unique—on Eastern Europe, which includes the poetic names of Samarkhand and Yuzhno-Sakhalinsk in its list of Aeroflot offices.

Briefly, if breathlessly, the 1957 *ABC* consists of the following: 30,000 listings of authorities, organizations, aircraft, operators, aircraft and engine makers, equipment manufacturers, airports, etc.; 35,000 names of aviation executives; 35,000 addresses of authorities, organizations and firms; an alphabetical list of aviation authorities and enterprises; an analytical list of air authorities and enterprises, arranged according to continents and countries; a five-language products glossary and buyers' guide; and a world aviation "who is where."

This 1957 *Interavia ABC* has been fully revised up to the end of January this year, and there is a stop-press section bringing it up to date to mid-March.

THE U.S.A.A.F. ON CANVAS

SPONSORED by the English Speaking Union, an exhibition of paintings by Frank Beresford of the European wartime activities of the U.S. Army Air Force (as it then was) and SHAPE is on view at Concord House, Charles Street, London, W.1. The exhibition ends at 5 p.m. today, June 7.

Apart from their artistic merit and æsthetic or sentimental appeal, the pictures form a historical collection of value, for—much to the artist's credit—most of them were painted on the spot and at the time of the event, and not recorded in retrospect from a collection of references.

The work—traditional in style, as is often appropriate in scenes "for the record"—includes a number of paintings of aircraft, portraits of Gen. Gruenther, Gen. LeMay and Field Marshal Montgomery, and an impressive picture of the American Thanksgiving Day service in Westminster Abbey.

SILICON-TRANSISTOR PRODUCTION

THE production of silicon transistors has been begun by Texas Instruments, Inc., at the Houston, Texas, factory of their Industrial Instrumentation Division. The company is thereby making use of the skilled manpower and new factory space now available to provide a second source for these transistors, some 36 different types of which are already under manufacture.

One of the largest transistor manufacturers, Texas Instruments established a British subsidiary factory near Bedford. Silicon transistors have particular advantages over crystal transistors in that they can withstand very much higher temperatures.

**Interavia (United Kingdom), Ltd., 14 Clarges Street, London, W.1. Price £4, postage included.*

Bush Pilot's Season

In Canada's Far North-west, where the Pilot Must be Jack of all Trades and Master of Most

THE author was at one time a production test pilot for a well-known firm of aircraft manufacturers in this country. Seeking more variety in his daily duties, he left to spend a season as a bush pilot in the North-west Territories. His reactions to the job form the subject of this article.

HUMANS and dogs excepted, the only living things were the bedraggled ravens, which had survived the worst of the winter, croakily disputing the ownership of some morsel salvaged from the rubbish bins. Otherwise, the world consisted of rock, snow and ice. Here and there a few jack pines or spruce with snow-encrusted branches clung precariously to the rocky slopes, whilst at odd intervals a denuded birch etched itself on the skyline in gaunt protest against the rigorous climate. Outside the office window the inevitable thermometer registered a respectable forty below: such was Yellowknife, Northwest Territories, in April.

Clinging to the northern arm of the Great Slave Lake, Yellowknife is a mining town of some two to three thousand inhabitants, situated about seven hundred and fifty miles north of Edmonton, Alberta. It is possibly the main supply distributing centre for the area of the Northwest Territories above that latitude.

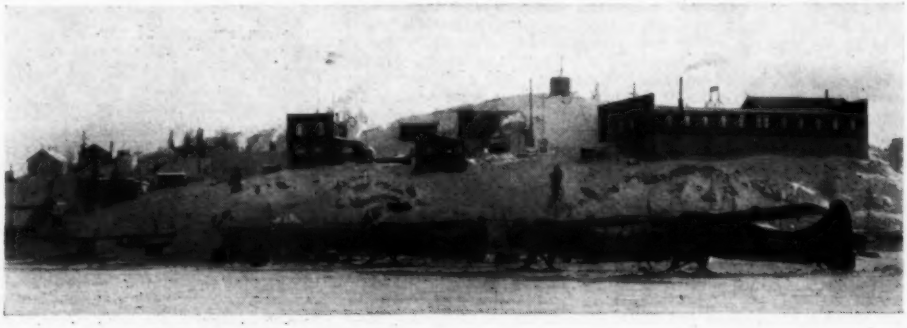
I flew for a firm equipped with Otters and Beavers for charter work over the entire area as far east as Hudson Bay, west to the Alaskan Border, north to the Arctic Islands and south for distances varying from two to three hundred miles. In the main the topography of this area consists of hundreds and hundreds of lakes, most of which are unnamed; and, to make matters even more confusing, a large proportion are apparently not important enough to be shown on the map. At first all looked alike, and it was at least a week before one had any idea of the approximate position of the aircraft, even within the local area of some hundred or so miles. As there were no modern radio aids, apart from a radio range (effective up to some sixty miles in certain directions only) plus the occasional beacon, it was mostly a case of contact flying. Such a method was a necessity when dropping or picking-up a prospecting party as near as possible to the chosen area for research. Picking-up was the easier process, as by then one had a fairly good idea of the length of run available and the hazards to be overcome before landing and after take-off at the particular spot. The fact that usually the camp-fire was still burning enabled one to judge wind-speed and direction, an otherwise difficult task amongst snow, ice and barren rock. Loads varied from the aforementioned prospecting parties, through the gamut of mining supplies for the established uranium and gold mines in the area, teams of husky dogs, Eskimos and Indians, to the judiciaries dealing summary justice to the law-breakers, and government officials inspecting the outposts. Husky dogs are in the main vicious and mean members of the canine race and, with nobody except the pilot to keep order aboard the aircraft, a heavy cudgel kept at hand sometimes had to be used unmercifully.

Aircraft engines were warmed each morning by means of hot air piped from small blowers known locally as "blow pots," and oil had to be thawed before it could be poured from the drums in which it had frozen solid overnight. Pilots were indistinguishable from Eskimos in dress; the best method of keeping the feet warm was by wearing at least two pairs of thick socks plus an outer covering of blanketing cut to enwrap one's foot, and having the whole encased in a pair of caribou-skin *mukluks*.

Each pilot was responsible for the loading and unloading of his aircraft—a good developer of back muscles when the load consisted of 2,500 lb and each pound had to be stacked whilst in a half-bent attitude imposed by the confines of the fuselage. The last thing to be thrown on—and probably the most important—was the mailbag. If by some mischance this was forgotten, it was then advisable to drop the load and take off again before the recipients arrived. The delight at the receipt of a long-awaited article was undisguised, and it will be many a long day before I forget the sight of a tall, lean miner crouching over the keys of a newly delivered harmonium, on a frozen lake, playing Beethoven's Fifth (as he termed it) to a crowd of non-English-speaking Indians.

With the thaw came the change-over from skis to floats, by no means the simple process imagined. Each aircraft was put on wheels; flown to the local airport; manhandled down the steep slope to the edge of a nearby lake; and hoisted on a huge tripod so that the work could begin. Meanwhile, other aircraft operated somewhat precariously from the ice on the big lake, a project entailing much boring with steel bars to test the thickness, and the added disadvantage that loads had to be hauled a distance of some hundred or so yards over the fast-breaking surface by toboggan. The warmer weather, too, brought the mosquitoes and blackflies, forcing one to work with one hand and maintain breathing space with the other. Those pests were present in the Arctic in far greater numbers than I had seen anywhere else in the world, and even two or three days' cold did not seem to affect them. Later in the Arctic summer they were ably assisted in their nefarious activities by what appeared to be a close relative of the horsefly, but which was known there as the bulldog, and seemed to possess all the iron-jawed characteristics of its namesake.

In the heading picture, a DHC. Beaver (operated by Wardair, Ltd., from Yellowknife) and a team of husky dogs—"in the main, vicious and mean members of the canine race."



(Right) On the frozen-lake "airfield" at Yellowknife, some typical architecture of which is seen in the background.

(Left) a Stranraer flying-boat seen over the Great Slave Lake; several of these aircraft, remaining from the batch built by Canadian Vickers in 1938-41, have given faithful service in the area. (Right) "In the main the topography . . . consists of hundreds and hundreds of lakes." The photograph was taken from 3,000ft.

BUSH PILOT'S SEASON . . .

Summer meant that hours of daylight increased steadily until the zenith of twenty-four hours was reached, and as this happened so the work hours kept pace. At such time of year all the major prospecting plans were put into operation and work carried on at absolute fever pitch in earnest endeavour to achieve as much as possible before the more or less paralysing grip of winter and total darkness descended.

Our first float work of the season, in conjunction with helicopters, was for a large oil firm at a camp on the Mackenzie River some three hundred miles below Aklavik. The banks of the Mackenzie (not unlike the Euphrates in both size and turbidity) were still lined with miniature icebergs when we landed, and the smaller blocks, which slipped as they melted into the fast-running waters, kept us awake by bumping noisily against the metal floats at night. One regularly slept aboard the aircraft—not such an uncomfortable process as it sounded, for one's sleeping bag was there as essential survival kit, together with an axe and food—and, in some cases, a firearm.

After about two weeks of operating in this area I was transferred back to base, where the more intricate details of float flying were instilled (a tricky business when one has to work an aircraft alongside a steep, rocky shoreline single-handed with the wind and current at opposite points of the compass). Finally, I was adjudged fit to operate solo on floats.

Some ninety miles north of Yellowknife is the tree-line, and from here to the Arctic coast the ground is a mass of rocks interspersed with innumerable lakes and rivers—country which merits its name of "The Barrens." This area is flat except where esks (glacial deposits up to eight hundred feet in height) mar the surface, or where dykes, upheavals of the subterranean strata pushing a layer or two of its composition up edgeways, run like the Great Wall of China as far as the eye can see across the wastes. With the dearth of landmarks and the compass unreliable, navigation was a nightmare, resulting in considerable reliance on the gyro compass. After landing, the technique was to cage this instrument on a line between two of the most prominent landmarks and reset on the same heading before taking off again. Each lake was inspected from the air for submerged rocks before landing; and in most cases a map was made to show any such obstructions, with a view to giving some indication of the safest landing and take-off runs.

One of the biggest problems was to find a sufficiently flat and large area on which to pitch the two-man tent for the night, as the terrain was a mass of broken rocks resulting from the expansion of the freezing water in winter. Animal life was not very prevalent, although from time to time a herd of caribou could be seen, invariably shadowed by the odd wolf; and one memorable day a herd of eleven musk-ox (now almost extinct) was spotted fording a river, whilst on the ground the sic-sic—a species of ground squirrel—would inquisitively betray its presence. Ducks and geese which had migrated from the Gulf of Texas were numerous; but, surprisingly enough, ptarmigan were scarce. In some areas the rock was covered in a carpet of moss and cranberry plants, and twenty-six or so varieties of miniature trees presented glorious colour contrasts to the blue of the Arctic sky on a clear day. With twenty-four hours' daylight, growth of plant life is extraordinary. At the settlements such things as potatoes and cabbages reach maturity in two months or less, and even strawberries are grown out of doors.

The possibility of bad weather loomed particularly large when one was engaged on long survey flights—perhaps of ten days' duration. If conditions became threatening a landing was made on a suitable lake; the aircraft was tied up, and one waited until the weather cleared—a procedure carried out so frequently that nothing was thought of a pilot being overdue by two or three days. As large sums of money were involved in the staking of claims, secrecy was essential on many operations; quite often, destinations were not disclosed until the aircraft was airborne.

Most of the light relief to the day-in, day-out routine of base operations came from the efforts of the various expediters of larger mining concerns and contractors to load the more alcoholically minded of their human charges aboard the aircraft. Frequently the expediters endeavoured to ring the changes with the allowable weight, a fact which became pitifully clear when one untied the ropes, only to see the tops of the over-sized water rudders submerge.

Canoe-carrying was the most unrewarding chore a pilot could have. Apart from the fact that these unwieldy loads cut down airspeed by ten to fifteen miles an hour the process of tying them on top of the floats inevitably resulted in cold, wet feet.

Float repairs, fortunately infrequent, entailed a tedious procedure of patching in icy cold water. If irreparable damage were suffered, or engine failure encountered, there was nothing one could do except sit and wait. It was incredible to see the improvization and ingenuity displayed by engineers doing major repairs *in situ* and with minimum loss of flying hours.

It was easy to see how the activities of bush aircraft are opening up the Far North and generally affecting its wellbeing. From haphazard beginnings charter work has grown to such an extent that the frequency of operation over some routes rivals that of scheduled airlines.

I found the life of a bush pilot by no means an easy one. Hours were long, climatic conditions were tough and navigation was of a kind which rendered many of the familiar methods useless. Now, when one almost has to seek Control's permission before lighting a cigarette, it is refreshing to recall the Northwest Territories and that individuality of outlook and operation necessary to cope with the job in hand.

INDEPENDENCE ON HOLIDAY

"Caravanning and Camping for Motorists," by John Yoxall. Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Illustrated. Price 8s 6d (by post, 9s).

CAR caravanning and camping are pursuits in which, more than in most such pastimes, a modicum of basic knowledge can make all the difference between depressing experiences and rewarding ones. Once the beginner has this grounding, he can profit easily and rapidly by experience; there is no question of learning the hard way.

A most useful guide to the art is provided by *Caravanning and Camping for Motorists*, a practical manual by John Yoxall. His name will be recognized by many *Flight* readers, for until he took over management of the photographic department serving all Iliffe publications he was for many years this journal's chief photographer and art editor. From the earliest days of car caravanning he has been one of its devotees, and in this book he puts his store of knowledge, accumulated in this country and abroad, at the disposal of others.

The author confines himself to essentials, not wasting space with unnecessary discussion of remote circumstances unlikely to be encountered by the average caravan user. Generously illustrated with photographs and drawings, the book deals with its subject under the following headings:—

Foreword by the Editor of *The Autocar*; introduction; choosing a matched outfit; interior layout; design and construction; undergear; brakes, tyres and hitches; beds and bedding; lighting and heating; water supply; sanitation; care and maintenance; caravan practice; going abroad; caravanning clubs; the law's demands; tents; camp beds, tent equipment; camping practice; the Camping club; conclusion.

XXIIe Salon International de l'Aeronautique

PART 1 · ONE MAN'S WEEK

by C. M. Lambert

THERE can be nothing in the world quite like the Paris Show. During the exhibition week that culminates in the final comprehensive flying demonstrations it is a free-for-all of demonstration flying, joy-riding and general more or less serious aeronautical amusement. This year three days were reserved respectively for commercial aviation, rescue and ambulance demonstrations and helicopter flying—in fact, helicopters and fixed-wing aircraft were busy until about 8 p.m. every day. Frenchmen, Englishmen, Germans, Czechs and Poles all got into the air and showed the paces of their products, or demonstrated them to passengers. While the helicopters leapt up and down, the small aircraft aerobatted; and through it all, as if nothing else were happening, came the civil airliners and the U.S.A.F. Globemasters and B-47s. To everyone's surprise, close calls were few. Sandwiched between descriptions of aircraft and appeals for parents to collect lost children, there were urgent loudspeaker appeals to demonstrating pilots not to start their engines before they had got their aircraft clear of the milling crowds of spectators.

So those who wanted to fly wheeled their aircraft laboriously through the crowds; the bowsers turned up as if by magic; and off went the aeroplanes on their various sorties. Through it all, inquisitive schoolchildren fingered every morsel of aeroplane in their reach—and stretched or jumped to touch what was further away. At the more critical moments the police restrained the crowds with Gallic firmness and kept them within the broad limits. The public ooh-ed and aah-ed and loved every dusty, windy minute of it. It was the aeronautical beano to end all beanos.

There were many indoor stands, but relatively few exhibitors' tents outside. Among technicians and sales representatives there was an easy *camaraderie* interspersed with keen appraisal of one anothers' projects. There was little lavish entertainment and everyone was accessible. The host of journalists from all countries were excellently supplied with comprehensive information and contacts by the Press section of the U.S.I.A. Such assistance was sorely needed, for very few French companies are as yet individually aware of the benefits or importance of good public relations and publicity.

The events of the first week-end were described in last week's issue. Subsequent days saw the arrival of many more aircraft, each taking its place somewhere in the great outdoor park. A ski-wheel Piper Super Cub joined the Apache and Tri-Pacer; the Klemm three-seater arrived; the Payen Katy (now with spatted undercarriage), the Aerfer Sagittario 2 and a second Durandal landed. There came, too, the German Multoplan, with propeller between fin and rudder; a Folland Gnat; and the Aubert Super Cigale in Air France flying-club colours. On the far side of the field the piloted Atar Volant was visible and a SS-10 launching jeep appeared; the Alizé hummed in late one evening, and the Fairey Ultra-Light arrived on its lorry; an Aquilon landed and had two Nord 5103 missiles attached to it; the Jodel-Wassmer D.120 Paris-Nice checked in; and a single Hunter landed from Germany and was later joined by a rather worn Venom F.B.4.

By Wednesday, the loudspeakers told us, 32,400 people had visited the Caravelle fuselage mock-up. And by Thursday, the helicopter day, there were no fewer than 45 rotary-wing craft to make a great threshing and twittering fly-past and massed landing. They included Djinns, Alouettes, Bell 47s, a Hiller, Vertol 44s, Whirlwinds, a Skeeter, an Ultra-Light, Sycamores and the SM-1.

The wind blew dust over everything and everyone, the sun beat down, the crowds milled everywhere and the sky was permanently dotted with aircraft.

In this atmosphere I went the rounds, talking to many people and filling in the background to knowledge of current French aeronautical activity. The fighter and ground-support situation, for instance, seems to be as follows. There are both French and NATO programmes for the light-fighter rôle. French requirements are based on two engines, and the Bréguet 1100 therefore has two Gabizos. The Aéronavale is strongly interested in this machine and a deck-landing version is coming along. The Mirage III, with a single Atar engine, is an Air Force intercepter. It seems certain that the two Nord private ventures, the Gerfaut and Griffon, are not to be ordered and that the S.E.212 Durandal is also an unlikely starter; reasons are not clear. The NATO support-aircraft are Bréguet 1001, Dassault Etendard VI and Fiat G.91, all to be powered by the Orpheus 12, which is reported to have much more thrust than present marks and to be rather larger. Comparative trials in September will decide the production contract winner. The Fiat has apparently *not* won outright.

The Sipa company showed a model of their 1100 twin-engined ground-support machine; and ten of these, it seems, are to be built straight away (the company will say nothing about armament). Parallel with this is the Sud Fonceur, also twin-engined, about which there is no information at all; two prototypes are ordered. In the small support-aircraft category there are the Potez 75, of which ten pre-production examples are on order, with a probable requirement for 100 in all. The Potez 91 is a single-engined attack aircraft in the same class, but no details are released. Morane Saulnier have revived the 1500 Epervier turboprop project, but it does not conform to the same scheme. Sipa are now so busy with various missile and target projects and with the production of Broussard fuselages that manufacture of the Coccinelle has had to be postponed, though a single machine has been delivered to the Argentine. A C. of A. has been granted and orders for about 300 Coccinelles should be immediately forthcoming.

I settled down with Dassault to talk about the new fighters. The Etendard is a scaled-down Mystère, with 45-deg leading-edge sweep, 2 deg 30 min anhedral and a 6 per cent wing. The Etendard II was an interim machine with two Gabizos and has now been abandoned. The Atar-powered IV is for the French Air Force, although a marine version is also foreseen. Present engine is the Atar E4 of 8,160 lb thrust, but production aircraft would have the Atar 8 of 9,700 lb. The VI has an Orpheus 3.

NATO have apparently classified 35 different types of unprepared surface from which aircraft may be required to operate, ranging from ploughed land to English lawn, and tyre pressures and sizes are arranged according to the type of ground which has to be used.

Etendard IV armament includes a 2×30 mm gun-pack or a

The heading picture shows the Barodeur touching down on its skids.

The Gerfaut—Atar-powered world-record climber—gets going.

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32×2.75 in rocket pack in the fuselage. There are two wing pylons, each of which can carry a canister of 19 68-mm rockets, or four or six 60-lb rockets, or one 1,000-lb bomb, or a 143-gal Napalm tank, or a 93.4-gal fuel tank. Fuselage tanks hold 473 gal and another 132 gal are in the wing. The IV is either an intercepter or ground-attack aircraft, and is pressurized. It carries the same radio as the Super Mystère B2 and weighs 12,125 lb as a fighter and (it is claimed) 22,046 lb for ground attack. The Mystère IVA weighs 16,535 lb and the SMB2 19,840 lb, or 24,251 lb at full load. One example has a dog-tooth wing but this is probably not to be carried on in production.

Etendard VI, the NATO machine, is unpressurized and will probably not have a fuselage rocket pack. NATO calls for 4×0.5in guns for ground attack—an American preference for rapid fire against soft-skinned vehicles. Two pylons will carry the same loads as the IV. The VI can achieve about Mach 1 "on the deck" in level flight and is very easy to handle under such conditions. All three axes are fully powered, with double jacks giving half-power, but full movement, in case of failure of one jack. Surprisingly, the slab tailplane has spring-feel, adjustable on the ground to suit different types of mission.

The Mirage is a delta intercepter, designed originally in an internal Dassault competition against the Etendard. The I has two Dassault Vipers with reheat and an S.E.P.R. rocket of 3,300 lb thrust. The sole prototype is still flying. The II has been ordered, but has not yet flown. The III has an Atar G1, but production aircraft would have the Atar 9 giving 13,230 lb with reheat. It is also to have an S.E.P.R. two-barrel rocket motor of 6,610 lb thrust and arranged to be jettisonable for crash safety (the rocket engine can be replaced by a fuel tank). The III has the same rôle as the SMB2 and a ceiling of 82,000ft, although it would run out of turbojet power at 49,200 lb. It weighs 13,000 to 15,500 lb and can do Mach 2 on the level. With a tyre pressure half that of the SMB2 it should take off from ground not softer than hard or p.s.p. It could land on grass.

At present the Mirage III has achieved M= 1.5 to 1.6 on the level at about 36,000ft *without* its rocket. It carries 572 gal of fuel internally and two 137-gal wing tanks (which could be replaced by bombs, rockets or Napalm). One of two Dassault radars —either Aida or Antigone—would be installed for use with a missile system. One missile or the 2×30 mm gun-pack would be carried, but—because of c.g. requirements—not both. The Mirage III has all three axes of control fully powered. Elevons are used, again with spring feel. Airbrakes are flap surfaces which open above and below the wing.

Dassault went on to tell me about some of their production equipment, which may well be almost unequalled in Europe. The SMB2 and subsequent types have a good deal of heavy forged and machined skin (Imphy make root skin sections and other parts with a 20,000-ton press constructed in 1939). Titanium is being used cautiously, and there is a special department for studying plastics and for making the necessary dies for production parts. Mounting-brackets for equipment, and other items such as fin-tips, are made in plastic. Dassault also have the only modern Anderson "forming-by-drawing" machine for making double-curvature fuselage panels. This machine will make a panel in six minutes, instead of the six hours normally required. Electronically controlled machines carve integral wing panels (some on the SMB2 cover a complete semi-span) from rolled planks 1.18in to 1.57in thick. The Etendard's complete semi-span wing skin, so made, starts at a weight of 661 lb and is reduced by machining to 132 lb. Curvature is applied by heating and by fastening to a slightly over-curved pattern; when the skin cools, it takes up the right curvature. A special large machine mills the complete semi-span spars of the SMB2 and Etendard while they are located by multiple hydraulic clamps.

Dassault built 360 Ouragans, of which 100 went to India and one group to Israel. Over 400 Mystère IVAs have been built and the series is almost finished. These were produced at the rate of 35 a month, working one shift in four main factories.

A most intriguing project is the Mirage IV, which is certain to be something quite new and may well be a bomber with supersonic performance. Dassault say that with this aircraft they will have to solve kinetic-heating problems.

This is most certainly a company to be reckoned with, both for design and production, and its record to date is impressive, to say the least. I later talked to M. Glavany, the Mirage III test pilot. He confirmed that the machine was both an intercepter and ground-attack fighter. It was, he said, a straightforward aircraft and suffered from few of the flying difficulties hitherto associated with delta wings, mainly because it had sufficient power to recover from the high angles of attack which normally lead a pilot into difficulties. He had apparently flown the small Avro 707 deltas.

I spoke about armament to M. Servanty, of Sud Aviation. He considered that the main disadvantage of gun armament for supersonic intercepters was the danger of debris from the attacked aircraft. The critical quality was range—and he mentioned that he considered no gun to have sufficient range, though he had not heard figures for the American Vulcan gatling. For control of supersonic aircraft he considered that the combination of spring, bob-weight and dynamic feel was adequate if devised to give good stick-force-per-g characteristics over a given part of the speed range; but more refined systems were necessary for constant values over the whole range. I asked about the B.10 bomb displayed under the Vautour wing in the static park. M. Servanty neither confirmed nor denied my suggestion that it was propelled and television-guided, but said that it was a new project rather than an old one.

The Leduc 022 was not, apparently, considered under any specific intercepter programme, but tests are going ahead at Istres. Of some 40 flights to date, about ten have been made with the ramjet lit. In this condition the Atar is throttled back and used only to give shaft-power. The lighting of the ramjet produces very considerable acceleration. I asked Leduc test pilot Sarrail why the 021 shown at Paris in 1955 had medallions of Our Lady and St. Christopher on the port control console; he replied that it was apparently at the request of the wife of M. Gonord, another Leduc pilot. All Leduc prototypes now carry such medallions.

M. Sarrail said that the Leduc 022 was a classic aircraft to handle. Visibility from the cockpit was better downwards and sideways than in other comparable machines; and the large prism, built in where a windscreen would normally be, gave good forward visibility at high angles of attack. The cabin escape system has now been slightly altered. To get away from the aircraft, the pilot has merely to pull a handle and hydraulic rams push the whole cabin forwards and downwards clear of the fuselage. Pressurization is maintained by automatic sealing of all apertures. A stabilizing parachute opens behind the cabin after 1.5 sec. Though a partial-pressure suit is required in case of sudden decompression after baling out, an equally important requirement is to keep the pilot from being frozen. The Leduc cabin retains both its warm atmosphere and pressure after jettisoning and the pilots therefore do not need pressure suits.

I made an appointment with Bréguet to discuss their very interesting projects and, being already engrossed in fighters, I started

The Bréguet twin-jet light fighter —the Type 1100 (two Turboméca Gabizos).

with the 1100 and 1001. Though designed to rather different specifications, these machines will eventually be fairly similar; the front fuselages of both are identical. While the 1100 has 210 sq ft of wing, the 1001 Taon has but 158 sq ft. It also is to have the Orpheus 3 of 4,850 lb thrust. When the 1001 gets its Orpheus 12 (Bréguet said this engine had 7,000 lb thrust) its wing area will be the same as that of the 1100 (incidentally, only the 1001 is called the Taon). The 1100 has large-span, very-narrow-chord flaps, and wide-chord, narrow-span ailerons combined with spoilers which rise vertically out of the wing ahead of the flaps. This system gives a rate of roll of 200 deg/sec at Mach 1. The 1100 will exceed Mach 1 in a dive at very low altitude. Fully powered controls are applied to all three axes, with feel system by Jacottet, using a hydraulic variable element in the aileron circuit. A S.F.E.N.A. yaw damper is fitted. The controls of the 1100 are by S.A.M.M. and those of the 1001 by Jacottet.

Bréguet claim that five times more wind-tunnel work was conducted for the 1100 than for any other fighter (a lot was done at Cornell Laboratory in the U.S.A.); and that, because of this, more flying has been done in one month than is usual in seven months at this stage. The test pilot is reported to have said that the aircraft has been right from the start and is so simple to fly that "he is waiting for Bréguet to produce a touring version."

Sixteen armament combinations are available for the 1100. They include either 4 × 0.5 Brownings or 2 × 30 mm D.E.F.A. guns, or a Matra fuselage pack of 35 Mighty Mice. Four pylons can carry the usual combinations of stores. Very extensive use is made of honey-comb sandwich in the airframe and the windscreen is a single curved panel of Triplex bullet-proof glass. The 1100 is pressurized, but the 1001 (in accordance with NATO requirements) is not, though provision is made for it. The elevator is a single slab and the leading edges of the wing droop sharply for high lift at low speeds. The curious shelf effect ahead of the intake is mainly designed to keep gun smoke out of the engine and does not affect intake performance at high angles of attack. The leading edge is drooped by a control separate from the flaps.

Bréguet have several interesting projects besides the 1100 and 1001. One of the original Vultur strike aircraft has been used for some time by O.N.E.R.A. for boundary-layer control trials, and coloured pictures of the work were shown on the O.N.E.R.A. stand. The system succeeded in reducing the Vultur landing speed from 93 m.p.h. to about 77 m.p.h. and gave very interesting handling characteristics. It could be applied to a full-span system, and the increased structure-weight it entails is considered to be less than the increased payload it would allow.

For the purposes of the trials the Vultur was given a double flap system, the forward flap being lowered to 25 deg and the rear to a total deflection of 70 deg. This left two spanwise slots in the upper surface. The forward flap was hollow, and air bled from the Nene compressor was led along spanwise pipes at the forward-flap hinge and ejected through nozzles in the trailing edge of the hollow flap. A jet-pump effect was produced, so that air was sucked in from above the wing at the first slot and blown out over the top of the rear flap. Forward and rear flaps began respectively at 72 and 85 per cent chord of the wing.

Bréguet also gave some information about the very interesting Intégral project. Construction of the fuselage (to go with the wing which is already being tested on a stand) is now in hand and a complete aircraft should fly by the end of the year. Of the powerplant, Bréguet said that, since the Turmo is a free-turbine engine, no clutches are required in the single spanwise transmission system which drives all four propellers. The standard Turmo reduction gearbox carries the individual output shafts to the level of the cross-shaft and the weight of gearing is not excessive. The turbine-to-transmission reduction ratio is 24:1, and there are two universal joints between each engine in the spanwise shaft.

The designers are still considering the use of differential propeller-pitch changing to provide directional control at very low speeds when lift is provided by slipstream rather than by forward speed; the steering engine in the tail has definitely been abandoned. The friction in the power system is so low that all four propellers and turbines can be turned by the pressure of a man's little finger against one of the propeller blades.

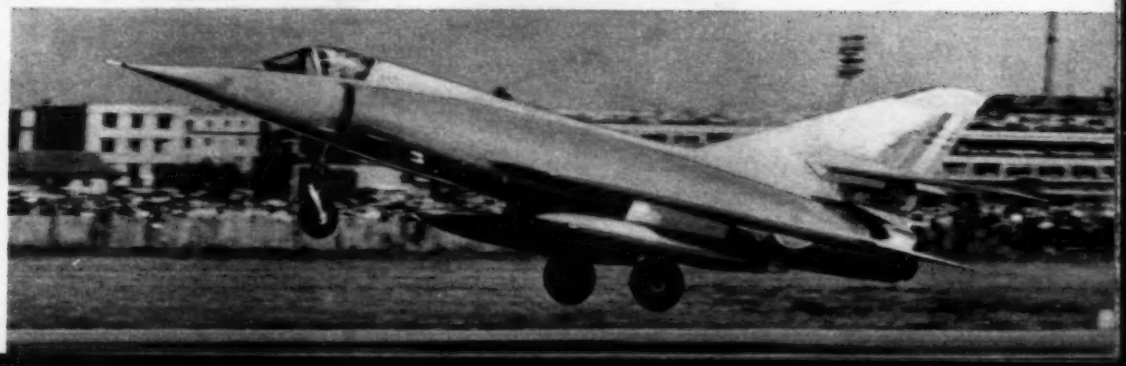
Production Intégrals would have the Turmo III of 750 h.p., but the U.S. Army is interested in a version with G.E. T58s. The French Army and the civil operators are apparently interested in another version, with Lycoming T53s.

Probably most significant for civil operators is the work being directed towards shortening take-off and landing. Both the Bréguet Intégral and the Atar Volant are remarkable examples of present design trends in STOL and VTO, but the Paris Show offered two notable examples of STOL aircraft actually in service: the Scottish Aviation Twin Pioneer and the Dornier 27. I made the return trip from Le Bourget to Issy and back on the regular Twin Pioneer shuttle service and was lucky enough to fly the Do 27B with Schäfer, its test pilot (this experience I hope to describe in a future issue).

The authorities had ruled that the Twin Pioneer must operate into Issy, the Paris helicopter airport, under Category A instead of Category C.. Under these conditions, the maximum take-off weight was reduced from 13,500 lb to 12,000 lb and fewer than the maximum number of passengers were carried. To allow absolute security in case of engine failure when clearing the built-up surroundings of Issy, the Twin Pioneer was taking off without flaps. The ground run was a little longer, but the subsequent climb was very steep indeed and the buildings were cleared with the greatest of ease (from Le Bourget, in a stiff breeze, the machine appeared to ascend almost vertically). Several return services were run every day; and the aircraft spent the night at Issy. Passenger-handling and general support were provided by Fenwick Aviation, the French agents for the aircraft. Scottish Aviation test pilot Roy Smith flew the machine with a co-pilot. The Pioneer is very comfortable; the noise level is low and the aircraft feels generally very pleasant and steady.

It is noteworthy that the Twin Pioneer was operating the same service as the Vertol 44 helicopter, carrying about the same number of passengers on each flight—the Vertol also had to carry less than its full complement (14 people)—and using the same landing areas. The rotary-winged machine naturally made a good deal more noise.

The Twin Pioneer was doing a job and as such was operating in a sober and straightforward manner, despite its impressive take-off and landing performance. But the Dornier 27 was being demonstrated and Herr Schäfer, the pilot, was really showing the crowds what the machine could do. His performances, given practically every day, were nothing short of amazing. and proved not only that he was an expert pilot but that the Dornier was, without any question, a truly remarkable aircraft.



(Above and right) Another impressive fighter—the Dassault Etendard IV.

An astonishing and portentous spectacle—the Ator-Volant C-400 P-2.

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PART 2 · PRESENTATION EN VOL by the Associate Editor

Saturday, June 1

FREE from its workaday traffic, Le Bourget is taking a quiet nap in the heat-haze. The guests of the Union Syndicale des Industries Aéronautiques are lunching in the sequestered hangar of U.A.T. Out by the runway the noon stillness is broken only by the sibilant passing of the Tu-104, taxying staidly and stiltily from the Salon park to position for the imminent demonstrations. And what a consortium of giants it joins: Britannia, DC-6, Caravelle, Valiant—all at rest under the hot, high sun. The distinguished silver-grey Russian seems perfectly at home.

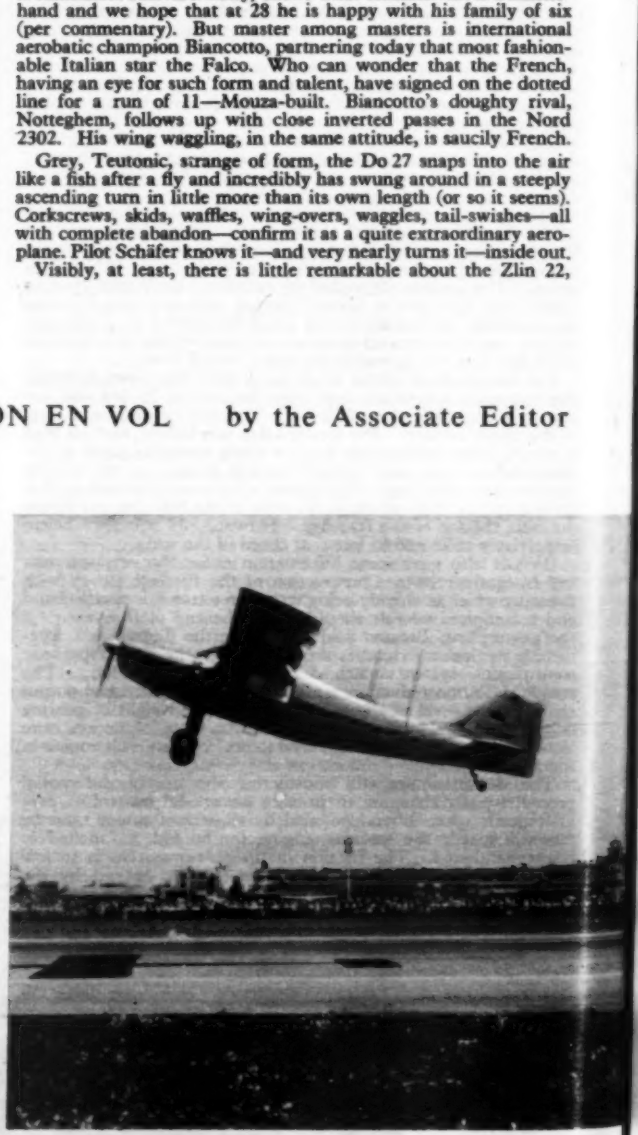
Precisely ranged beyond are the aerobatic teams of four nations (no Mig-19s, alas), all serviced and ready to contest the honours of the day. A blissful breeze just teases the flags along the tribunes . . .

Around 1.30 the voice of Jacques Noetinger—journalist, pilot, publicist, commentator—sounds out along the fast-filling enclosures. He bids a welcome; and the show is on.

Instantly before us is the dainty Jodel-Wassmer D-120, in red and yellow, purring and playing above the runway: an irresistible kitten. Then Poland's blue and silver Bies, nosewheeled and sturdy, as a trainer of its sort should be, is airborne for its smooth, if sometimes Harvard-noisy, show. Pilot Ablamowicz is a master-hand and we hope that at 28 he is happy with his family of six (per commentary). But master among masters is international aerobatic champion Biancotto, partnering today that most fashionable Italian star the Falco. Who can wonder that the French, having an eye for such form and talent, have signed on the dotted line for a run of 11—Mouza-built. Biancotto's doughty rival, Notteghem, follows up with close inverted passes in the Nord 2302. His wing waggling, in the same attitude, is saucily French.

Grey, Teutonic, strange of form, the Do 27 snaps into the air like a fish after a fly and incredibly has swung around in a steeply ascending turn in little more than its own length (or so it seems). Corkscrews, skids, waffles, wing-overs, waggles, tail-swishes—all with complete abandon—confirm it as a quite extraordinary aeroplane. Pilot Schäfer knows it—and very nearly turns it—inside out.

Visibly, at least, there is little remarkable about the Zlin 22,



Two of the "new European" contenders in world markets: left, the Fokker Friendship; above, the amazingly tractable Dornier Do 27.

Twin-jet liner, Russian style: the Tupolev Tu-104.

from Czechoslovakia. But in the hands of one Blaha it differs from the general run of trainers in going through its aerobatic repertoire in attitudes the reverse of normal. A tough, obliging little aeroplane: a superb pilot: a heart-tripping performance—but sufficient negative g for the moment.

The Max Holste Broussard, Potez 75 and Scottish Aviation Twin Pioneer are less given to cartwheels and handstands. They are what one might call multi-purpose specialists with responsible jobs. The blue-and-white Broussard (pilot Jouannet) is fitted out for agricultural work; the drab, sober "75" (Détré) impresses by its staunch dependability (it is intended, indeed, for police duties in colonial service); but the Twin Pioneer is conducted by Roy Smith more like a Paris taxi than the big station wagon, or small bus, which the McIntyres of Prestwick intended it should be. There is nothing like it at Le Bourget, nor (it is pleasant to reflect) elsewhere.

Here, now, are André Moynet in the H.D.34 and Ian Forbes in the H.D.M.105, putting on a sort of Box-and-Cox act which is subtle, telling propaganda for the richly promising ultra-high-aspect formula. This attentuated pair of aerodynes would hardly be out of place at Lasham; except that every now and then the H.D.34 reminds one quite definitely that it does have engines.

New, and not-so-new—Dutch and Russo-Czech—approaches to the fast-resolving feederliner problem are the Fokker Friendship and Avia 14: which is not to imply that the Avia is a has-been. (Far from it, as colleague Lambert will testify next week.) Both pilots are in frisky form. Burgerhout takes the Friendship over the vertical against a dead Dart (killed at take-off) and Kaustik gives the scenery a good going over after a short-field departure. He touches down and brakes with such determination that he blows one of the four main tyres.

Behold, now, a wheeling silver vision—the Britannia 301. Britannia the beautiful, the silent, the magnificent. She passes by and France pays homage. That is the simple, evident truth; and there is nothing more to say.

Something of that same "big-liner" stateliness is seen now in the Leonides-Herald; but liner or not, "Hazel" shows that there is nothing fine and fancy about *this* aeroplane. It snaps to the job—sharp. No fuss. No frills.

Vallette, in the Marboré-boosted U.A.T. Noratlas (Nord 2502) gets off well with full traction and thrust, cuts a Hercules and continues with "two burnin' and one turnin' " till touchdown. Then, as Wally Gibb sets the Britannia down, we hear a most curious sound from the opposite end of the runway. In no time a swarm of beating, whirling, flapping, chugging, flailing helicopters is upon us. Seven Djinns in the lead—or is it eight? The elegant Gouverneur skating swiftly beneath. Eight Alouettes. Check. An S-55, an S-58, and the two big Vertols bringing up the rear. There is a scrambling, wheeling into file, a rushing, shuffling by, and again silence.

Glossy white, black-beaked, wing-tanked, thunderously quaking with power, a Valiant takes off like a great sea bird. A slow run past; a second—then forward go the throttles, back comes the stick, up goes the nose, back stream dark Avon-trails, and up, up, up, goes the pride of Bomber Command.

Now, whatever people may be saying, we have seen that Britain really is at Paris; and here is Bill Bedford in the blue and grey Hunter T.7 to remove any doubt about it. The Avon blasts and screams at five-figure thrust. The Dunlop "anchors" are held fast-on; then abruptly snapped off. Off goes the Hunter like an arrow, up, and out of sight. Confused and half-stunned, a hare goes leaping over the grass. The *pompiers* of the crash-crews are just abandoning their calling for that of *chasseurs*, when, without warning, their hard-pressed quarry receives the disconcerting

Twin-jet liner, French style: the S.E. Caravelle. A cockpit commentary was transmitted over the public-address system.

Left, the Italian Air Force F-86 Sabres begin their smoke-laying.

Above, a hard worker and effective demonstrator was the Twin Pioneer.

Lower left, the black Hunter 6s of No. 111 Squadron, Royal Air Force.

Upper right, the Hurel-Dubois H.D.34—for geographical survey.

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blow of the returning Hunter (50ft, 600 kt), more or less instantaneously with both barrels of a choke-bored supersonic bang.

Le Huntair, we are apprised, is a design of a Mr. Sandy Camm.

Whether by design or not, Johnny Baker's breezy-as-ever show on the Shackleton 3 (sometimes with three Griffons shut down) is followed up with a second demonstration of anti-submarine aircraft. The tail-markings show that they are the first three of the new Bréguet Alizés—turbine-engined (Rolls-Royce Dart), trim, ship-shape. Bruneau leads in an exposition of radome-and-hook extensions, weapon-bay openings and carrier approaches.

Likewise in naval style is Grangette's performance on the Fouga Magister Marine, with an eight-point nautical roll as a speciality. The virtuous-looking butterfly-tailed, butterfly-dainty trainer is slammed on to the deck at the rate of knots, giving way to the seven deadly Hunter 6s of No. 111 Squadron, R.A.F. With their black skins and raked fin-flashes they resemble—if not sins— then so many fearsome congers. These, as Jacques proclaims, are *Les Ambassadeurs de la Raf*. We have never witnessed any better, and it is a privilege to record the names of the pilots as S/L. R. L. Topp, F/Ls. D. R. J. Hall, G. P. Aird, D. M. Goodwin and L. Swart, and F/Os. C. Garratt and J. A. Wheeler.

They are off in arrow formation, with the two spare men (the aerobatic team numbers five) abreast in the box. The action opens with the "spares" crossing over on the deck, at searing speed—coincident with the arrival and looping of the five in "box". Formation changes follow rapidly—into fork, arrow, bow, swan and "card five"—each change precise, snappy, clearly in view.

Sometimes the formation is such that the outer men have no direct view of their leader, and we reflect that while "Treble One's" French, American and Italian rivals are appreciative of this point, the public is aware only of a superb, thrilling piece of flying. The end comes with a downward formation-break like a burst of shrapnel: then a surging wave of spontaneous acclamation swells along the enclosures as the black Hunters nose in for a stream landing.

Bravo le Raf. Bravo Treble One.

Powered like the Magister, with two Turboméca Marborés, is Spain's Hispano Aviacion Saeta, less elegant than the French trainer, but a very workmanlike little aeroplane, of true Messerschmitt stamp. The pilot is Pedro Santa-Cruz, and his dashing side-slip approach (we are assured by Mark Lambert, who has had first-hand experience of Santa Cruz's piloting) is a signature-manœuvre.

Somewhat aloofly, three Fouga Magisters of the *Ecole de l'Air de Salon* give the first formation-aerobatic demonstration on this type of trainer. By no means aloofly the pulchritudinous red-white-and-blue Morane-Saulnier Paris executive/liaison four-seater reminds the assembly that, flown *biplace*, it, too, serves as a trainer —and a notably fast and manœuvrable one at that. It is just the aeroplane for the Shah of Persia, who is, indeed, among the latest buyers.

What the Britannia did for British pride and prestige, so, now, for France, does the Sud Aviation S.E. Caravelle. A beautiful name; a beautiful aeroplane; a beautiful set of cost curves. Nadot gives a commentary from the cockpit as he pilots his craft silently round the blue.

With Napier rockets giving (pyrotechnicists please note) a catherine-wheel effect, to aid the Gipsy Major, the scarlet Saunders-Roe Skeeter demonstrator (Ken Reed up) whisks vertically aloft before the Presidential enclosure. A very pretty rate of climb. And, speaking of climb, the rakish-looking little delta now nosing on to the runway is the world's record holder. This is the Nord Gerfaut, an Atar-powered light intercepter, razor-thin of wing and, one might suppose, a long roller. But nothing of the kind. The Atar eyelids blink open for reheat, the stubby little delta projects itself forward a modest few-hundred metres and is up and away. Turcat was to have read off the progress of his breathtaking climb; but something seems to go amiss and he signs off at great height with a white trail (probably of fuel). Better luck tomorrow.

A challenge is straightway thrown down by the Sud Durandal —again having Atar power, though lacking for the present its SEPR rocket. Its unstick run looks longer than the Gerfaut's, but it climbs as nearly vertical as makes no difference, comes flashing back (rocking a little if one's eyes do not deceive) and at length comes in to land at quite a modest speed.

A KC-97G and B-47 of the U.S.A.F. demonstrate boom refuelling.

Attention is now directed to the far side of the field, where, like some fantastic Wellsian creation, stands the C-400 P-2 (piloted) Atar-Volant—an experimental VTO rig. The worthy Morel is just discernible on his ejector-seated perch and the Atar is running. There is a sudden fierce flurry of dust, and now—phantasy of

phantasies—the grotesque, stilty undercarriage is off the ground and the great metal cylinder is moving up and across the sky at 100ft. In 25 years of air shows we have witnessed nothing to equal the drama of this spectacle. One feels confronted with some new, fundamental truth—and one does not forget the pioneer work of Rolls-Royce in much the same direction. One finds oneself recollecting that in 1909 the Wrights had learned to fly somewhat in the manner of birds; but here, before us, is man, not flying, but walking on the air.

Across the field Morel conducts his precious cylinder, and exacts from it a curtsey for the other V.I.P.s (for he himself, in our own estimation, is one indeed). Then round and round above its dust-cloud he revolves the Atar like a propelling pencil, till at last, he sends it roaring hundreds of feet into the air finally setting it gently back in its corner.

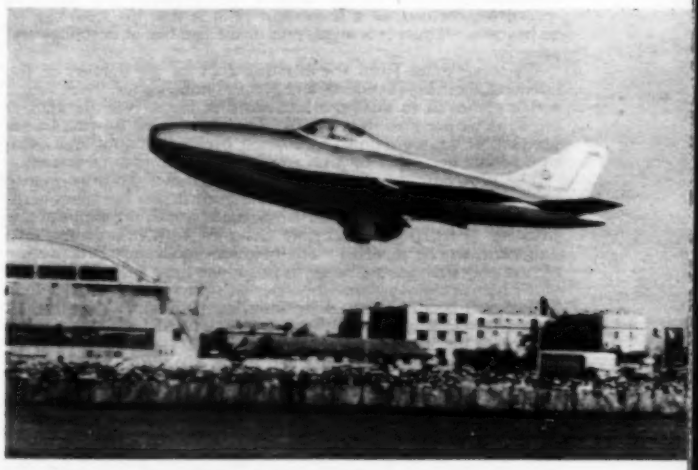
In these enlightened days the supersonic bang is held by some connoisseurs to have become a little passé—even corny. We disagree; and knowing that Mike Lithgow aims to park a pair on Le Bourget with the Scimitar (he was scheduled off before the Atar-Volant), we are as tense with expectancy as anyone. Et maintenant! Attention! Le Scimitar. Crack, crack! A pair of crackerjacks . . . and there is Mike proceeding with his show.

A twin-jet fighter/attack machine as small as the Scimitar is large is Bréguet's Type 1100 Taon, Gabizo-powered. A good-looking youngster this—twin brother of the Orpheus-powered 1001 for NATO. It has spoilers as well as ordinary ailerons; and slats. Acceleration and take-off run seem nothing extraordinary, considering its rôle; but here, evidently, is a very promising aeroplane. Pilot Bernard Witt considers handling qualities to be such that he is said to have advocated the building of an executive version straight away!

To keep things moving France's most secret fighter—the Dassault Mirage III delta—passes over at 600 metres. It is not stopping. Jacques Noetinger declares that it can climb to heights never before attained in Europe.

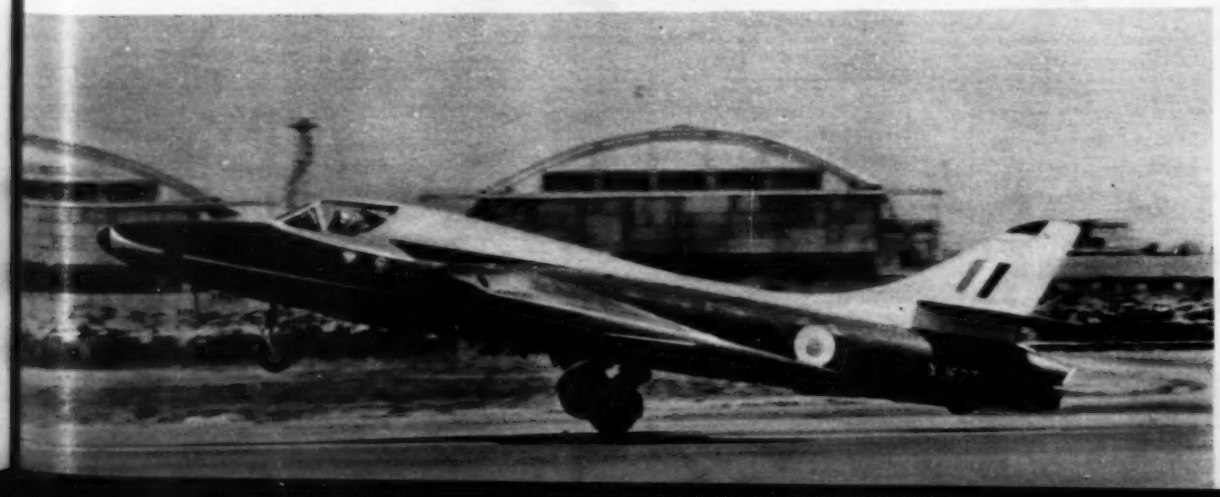
Representing Dassault at Le Bourget (at this very moment in the air, after a run of perhaps 500-odd yd) is the Etendard IV fighter/attack Atar-powered prototype. It carries under-wing tanks and puts up an uncommonly fine show. Very tight turns are a special line; and with flaps and droop-snoot operative, and the twin-panel, under-fuselage air-brake down, it displays good low-speed characteristics. Landing roll, with ribbon chute, is, perhaps, 600 yd.

The Italian industry could have had no more popular, or typical, representative than the Sagittario II light Derwent-powered fighter, pilot Franchini. It unsticks nimbly, darts around, and for no obvious reason comes in for an under-shoot, throw-on landing. Then on the instant it is off and up again, rolling *à grande cadence*. A fascinating performance. The Italians, of course, have always had a flair for demonstration flying—the Air Force in particular—and that Service is represented today by a formation of Sabres. These get away in very close formation and continue so throughout their show. C.M.L. (who has an eye for such things) considers that they have combined British formation changing and air drill with American-style precision flying, and have added a small, but so-effective, touch by emitting white smoke for their bomb-burst and cross-over. The final form-up is an eye-catcher, and their circuit is low and slow and tight. They land in box formation.



There is always talk at these Paris Shows about light fighters; but Ted Tennant (35, family of two) gets airborne in one which is fresh from a real production line. The Gnat, of course, is an irresistible charmer, and its turns today are of control-line order. (Someone, hearing the rush of air in the Gnat's wake, describes it as a rustle of spring-feel.)

The Aerfer Sagittario II light fighter (centre above) has the appeal of an Italian sports car. Below, Bill Bedford gets off in the Hunter T.7.



A notable light intercepter by Sud Aviation—the Durandal with reheat S.N.E.C.M.A. Atar turbojet and provision for SEPR rocket.

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Maulandi of Sud has long since discarded the wheeled trolley for taking-off the Baroudeur. That eyeable attack-fighter kicks up a bit of a protest and dust, but the Atar pushes it out of the rut without ceremony. A very nice, tractable aeroplane from all accounts; and it is good to hear that it is still in the NATO running. (Someone who knows and likes it well remarks that the only special requirement of a Baroudeur pilot is that his teeth should be his own. There is a suggestion of the tumbril at *décollage* and *atterrissage*.)

Welcome relief from the blasting fury of jet fighters is the booming, looming passage of a U.S.A.F. Globemaster. The *camion aérien* comes in to unship a half-score of jeeps. We are glad to see it, as we are glad to see a tidy, straightforward fly-past by six production Vautours flown by French Air Force pilots, and a real commercial departure by a DC-6 of U.A.T., Brazzaville bound.

The proceedings have now passed well down the third quarto page of the programme, and France herself makes her main aerobatic offering, with the tricolor emblazoned across the wings of five Mystère IVAs. [Once again we defer to C.M.L.'s professional judgment, and he reports: "The Mystères made very effective use of precisely timed sonic bangs to introduce their show and to sign off. Their demonstration, however, was rather slower in pace than it need have been, with too many long, low turns and a slow fly-past soon after starting. Their flying was very graceful, but they did not match the pace of the other teams."]

Speaking for oneself and a few hundred thousand others this was a pretty show, nevertheless.

We cannot believe that the Skyblazer's opening-up of J57s just as the Tu-104 is about to be introduced to the assembly is intentional. But it is none the less regrettable. (This particular 104, we reflect, is tangibly here, whereas another dark horse bearing the same number, and promised from a Western stable, is not.) The Soviet transport takes a moderate run and looks good in the air. It attempts nothing spectacular; but the Westland Whirlwind and Widgeon most definitely do—as they did at Farnborough—and quite definitely succeed. The Whirlwind's "wing-overs" make a great hit with the crowds.

J. G. P. Morton, with the Fairey Ultra-Light, gives our hosts a not-so-gentle reminder that the turbine-helicopter field is not exclusively theirs; and in their turn the French—with three Super Mystères—remind Great Britain that they have level-supersonic fighters nearing operation.

As for the Skyblazers, and their mighty Super Sabres, they impress by their mere appearance and by the fearful bangs of their afterburners. Here is a team to rank with the black Hunters. They use to the full the noise and fury of their machines, combining with it exceedingly close and superbly co-ordinated flying. An astounding manœuvre is their sudden opening-out from box formation, followed by individual rolls, with the lead and box men close in together, and the wing men about a span distant.

The show is fast and furious when one F-100 is seen to drop from formation. Something is wrong. The seconds drag by and the public address is silent. At length an F-100 is seen approaching downwind, its team-mates shepherding it in. Landing, it rolls into view, and we see the ram-air turbine protruding from the fuselage, proclaiming a flame-out. The F-100 emits strange metallic noises and its last few pounds of inertia are used by the pilot to swing off on to a taxi-track. He is a resolute and lucky man. His companions continue with their star-spangled show.

An Agusta-Bell, the Polish SM-1 and the Bristol Sycamore round off the notable helicopter contribution on this day of spectacle, colour and drama: and now—finale—with 48 Mystères of l'Armée de l'Air in swift, orderly passage overhead.

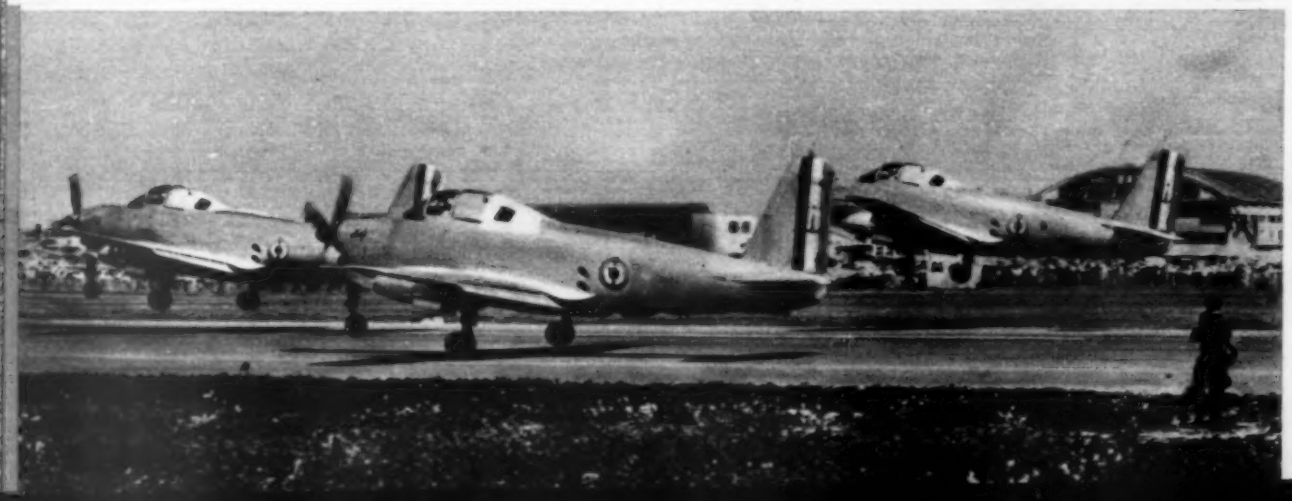
Sunday postscript. So far as one could judge (having left around five o'clock for Orly and home) today's offering was, if anything, finer. The Super Aero took over from the Aero 14 and three French parachute instructors made a heart-stopping, smoke-trailing delayed drop from a Noratlas at 6,000ft.

For Britain, T. E. Lampitt of Napier (many readers will remember his article on formation aerobatics in *Flight* of June 1, 1956) brought over the Scorpion-Canberra; and his demonstration was exactly what was needed to consolidate the British contribution. With the Scorpion spitting fire he hauled the rejuvenated B.2 round the enclosures in Beamont turns, and as he upward-rolled from the scene he may well have recalled his successes with "The Fighting Cocks."

Turcat, in the Gerfaut, topped the height of Everest in 67 seconds.

The foregoing Paris Report is illustrated with "Flight" photographs.

A pleasing reminder of Anglo-French co-operation—the three Bréguet Alizé anti-submarine aircraft with Rolls-Royce Dart turboprops.



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The S.A.M.M. tandem control servo, interchangeable with the Lockheed units of the Caravelle.

The very small Air-Equipment RCB-2 radio compass and (top) the S.F.E.N.A. flight director instrument.

PART 3: THE GREAT INDOORS

THE great hall of the Salon de l'Aéronautique at Le Bourget this year was divided into more than 250 stands. Of these the largest and most commanding had been taken over by American aircraft and engine manufacturers. Though some new American engines were shown, there was little of interest in the way of aircraft; the purpose of this concerted representation was possibly designed to offset any possible Russian participation in the show. There was no apparent co-ordination of the British representation, but a good number of airframe, engine and equipment manufacturers had stands of their own, while many French companies were displaying equipment of all kinds manufactured under British licence.

There was also a good deal of equipment made under American licence, and it was interesting to note that both American and British practice was being followed in the design of such items as ejection seats and flight instrumentation.

Altogether about 200 French companies work for the aircraft industry, but of these relatively few cater solely for aircraft requirements. A total labour force of about 25,000 was involved in "accessories" last year. There are five companies employing more than 1,000 people solely on aeronautical work: Air-Equipement, Bronzavia, Messier, S.F.R. and French Thomson-Houston. The two last-named companies are both involved in missile guidance work. From the point of view of variety of products the static display at Paris looked very much like that at Farnborough. Metals, metal-working, plastics, manufacturing processes and small accessories and equipment were all represented. Aircraft accessories and systems were also well to the fore, with a strong representation in all these fields by the Bendix Corporation.

Many companies are involved in the manufacture of instruments of all kinds. Some concentrate on engine gauges, others on pressure instruments and others again on gyro instruments. Some companies design their own and some simply produce foreign or French instruments for others. Jaeger showed a range of pressure instruments including altimeters with Veeder presentation of thousands of feet. One instrument had Veeder indication of hundreds of feet. A combined A.S.I./Machmeter appeared to have an American-type presentation.

S.F.E.N.A. have for many years produced artificial horizons, and they showed two types at Paris. One was an electric unit, fully free in roll and free up to 85 deg in pitch, the erection device being a pair of bearing-balls in a circular trough on top of the gyro case. Each bearing-ball could roll through about 90 deg and cause erecting moments. To prevent erection during prolonged turns, application of steady bank caused pendulous weights to bring down wire stops to hold the balls still. The other horizon was a new type with a cylindrical two-coloured "sky-plate" which revolved to show dive and climb on a graduated scale. The whole cylinder rotated about a longitudinal axis to show bank angle.

The Czech sales-agency Omnipol showed a glider turn-and-slip indicator operated from a 4V torch, the cable screwing into it like a torch bulb. Their electric horizon used a free ball as a sky-plate and maintained the same freedoms as Western horizons. Its spin-up time was about 40 seconds.

S.F.E.N.A. claims to have developed a successful inertial navigation system, which uses rather different principles from those so far applied in America or Britain. (They also believe that the Russians are well advanced in inertial techniques.)

A new flight-director instrument has been developed by the French company and is to be installed in all Noratlas after the 140th and in all Vautours. Outwardly it looks much like an ordinary horizon but it presents attitude and instruction information for flying with a height lock, and for using I.L.S. Since there is as yet no V.O.R. in France this kind of flying is not catered for, but could be easily added. The aircraft image moves relative to the attitude-indicating horizon bar to give instructions for asympototic approach to a localizer beam. A compass window in the top edge of the instrument allows course-selection and setting of drift angles. Inbound and outbound I.L.S. presentation can be set, and glide-path, course-holding and height lock are incorporated. The whole system is very light and compact and appears remarkably clear and simple to use. The French name of the instrument is *synthétiseur de vol, Type 611*. Any loss of proper instructions will cause a mechanical lock to be applied to the aircraft image so that the instrument becomes a normal electric artificial horizon.

The Type 611 is used as a flight monitor and coupler for a three-axis autopilot, also destined for the Vautour. This system has attitude and rate gyros and controls all three axes. It has a height lock and central amplifier, is very light and is electrically operated. The S.F.E.N.A. Type 247 yaw damper uses a rate-gyro with electro-magnetic instead of spring damping, so that both the sensitivity and freedom of the gyro can be altered according to signals from a pitot-head dynamic and static source. Sensitivity is from $\frac{1}{4\frac{1}{2}}$ deg/sec to 10 deg/sec. The Type 30.9 is an automatic elevator control fitted to the Dassault SMB2 and Sud Trident. It uses a feel unit and an electric jack in parallel, controlled by a rate-gyro, an angle-of-attack senser and static and dynamic pressure senser so that the pilot receives feel indications proportional to load factor while also having stability augmentation and automatic compensation for over-control and pitch-up. This equipment, in fact, gives complete elevator control for normal manual flight and makes an aircraft extremely easy and pleasant to fly. Actuation is entirely electrical.

Finally S.F.E.N.A. exhibited an ingenious short-range navigation computer using a slipstream-driven propeller to record aircraft movement rather like a ship's log. Speed and distance from this are fed to a mounting holding a tiny aircraft image in a case behind a glass dial, a compass signal being added to give direction. A cursor with range marks is set against a compass rose on the dial to show distance and course to a destination, and the aircraft is flown to make the image follow the line. Return to base is by steering the image back to the centre of the dial. Tests are in hand and accuracies of five per cent reported. Total weight is 6.9 lb.

A most important and significant development displayed by

Aérazur partial pressure suit, E.F.A. helmet and Vergne-Intertéchnique suit regulator on the Intertéchnique stand. The regulator can be fitted to the back of the seat, as shown, or stowed in a foamed plastic casing in the dinghy pack. The equipment is based on American design.

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Radio-A.I.R. is a new navigation system called Radio Mailles. It is a hyperbolic radio system using four ground stations in each network. Since the position signals are derived only from a modulation of a carrier, any frequency can be used, and static interference is negligible. Accuracies sufficient for aircraft, but not for surface navigation in estuaries, can be obtained. The modulations produce a substantially rectangular lattice of equi-phase lines which move from corner to corner across the zone in opposing directions. Position sensing is by time-comparison. Any ambiguity distance can be chosen (in the present 100 sq km system it is 621 miles) and the recorder needle in the aircraft will automatically return to an accurate position indication after being upset for any reason. For the present test network in France a frequency of about 1,800 kc/s (Loran band) is being used; and 600 and 250 kc/s have been tried.

Because of the particular position-sensing system used in the aircraft, a position signal can be automatically transmitted to a ground station and displayed on a cathode ray tube. This in turn can be converted to a television signal and projected on to a large screen. Height information can also be supplied. The complete aircraft plot on the ground can then be re-transmitted to a radar scope in the aircraft to provide collision-avoidance information to the pilot. The whole airborne equipment weighs about 132 lb, but would be made lighter in production. A 300 sq km network is now being set up; and existing radio-navigation beacons could be used by modulating their signals.

Finally, a selective radio transmission system can be tied in with Radio Mailles so that a particular aircraft could be selected to receive a radio message. Traffic control of many aircraft on one frequency is therefore possible, without the need for listening out on that frequency. Development continues and America, Britain and Germany (Lorenz) are showing considerable interest. A military advantage is that the carrier frequency can be changed without disturbing the modulations used for position fixing, thereby making enemy interference less likely.

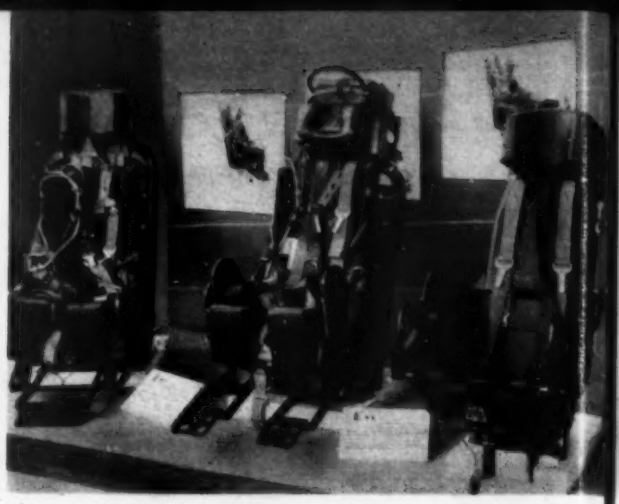
Air-Equipement showed a range of equipment for aircraft, and particularly a radio compass which is smaller than any complete unit yet shown. It covers the 200-800 kc/s band, uses a 27V D.C. supply and weighs less than 11 lb. The company is also developing a range receiver for light aircraft weighing less than 10 lb. It indicates bearing on a left/right pointer and shows whether the aircraft is headed to or from the beacon.

Compagnie Générale de Télégraphie Sans Fil showed a portable television link using a camera weighing 3 lb with a 14 lb transmitter of 5W power. It was used from a Djinn helicopter during the show and, in back-pack form, on the ground. Viewers at strategic positions presented the results.

The S.F.R. company has produced a radio altimeter weighing 30 lb without cables. It uses a frequency modulation system and has two ranges, 0 to 1,000ft and 1,000 to 5,000ft. Indicator lights can be set for a given altitude. Accuracies of plus or minus 10ft up to 100ft, and 10 per cent at greater heights, are quoted. The same company has the Type GA 571 radio compass for from 150 kc/s to 2,000 kc/s with a total weight of under 29 lb. The receiver is in two half blocks; the loop is magnetic-cored; a vertical aerial is provided for removing ambiguity.

The Société Nouvelle de l'Outillage R.B.V. displayed their "3-D" radar on a gyro-stabilized mounting for ship-borne use. The aerial feeder horn is so shaped that the set can detect both azimuth and height of aircraft. Two displays separately show plan position and height. Civil versions are available and mobile installations for the French army have been produced. According to the model used, ranges of 40 to 100 or 200 miles can be covered.

The S.F.E.N.A. three axis autopilot for Noratlas and Vautour. Attitude and rate gyros, height sensor and flight director coupling are provided.



Three of the range of Sud automatic ejection seats for Mystère IVA, Vautour and other aircraft. Either Martin-Baker or American automatic mechanisms are applied to Sud's own welded-tube frame.

The Société des Télécommunications Radioelectriques et Téléphoniques is producing a subminiature U.H.F. or V.H.F. transmitter-receiver for carriage in a Mae West. Its beacon signal can be received at 50 miles' range at 10,000ft and it weighs altogether 21 oz without batteries. Two-way voice communication is provided.

Two of the principal powered control manufacturers in France are S.A.M.M. and Jacottet. Both are now engaged in producing a wide variety of powered control units for the new French fighter aircraft. S.A.M.M. has for many years been well known for its hydraulic equipment and powered control units. The present range includes a tandem jack which is interchangeable with the Lockheed Servodynes now fitted in the Caravelle. The valve operating forces are considerably reduced. A double-body unit for the Bréguet 1100 gives a force of 12,345 lb for a weight of 19.6 lb and a special spring centring device is provided for the valve. The spoiler jack for the same machine is a single unit with automatic changeover from main to secondary hydraulic supply. A unit for the Durandal has a fixed piston and moving body with a mechanical lock which directly connects the surface to the stick after hydraulic pressure falls below a given level. There is therefore automatic and positive manual reversion. Three of these units are mounted in each wing and one at the rudder. A Hobson feel device is also used. The Durandal is reported to have three control surfaces on each half span, arranged so that the number and angular movement of the surfaces in use is reduced as the indicated airspeed builds up.

S.A.M.M. also showed a very small aileron power-unit for installation in the Magister in order to accustom pupils to powered ailerons. An even smaller unit was designed for the Alouette rotor head. It weighs 1.54 lb and gives 220 lb thrust, with a sensitivity threshold of 0.027in. This movement becomes a negligible backlash if hydraulic power fails.

All these controls employ a special rotary valve which gives very low operating forces and is well balanced. A blockage due to dirt in the hydraulic fluid has never been known in these units. The company is also designing an electric servo-motor transmission between stick and powered control which will eventually be combined with autostabilizer signals and duplicated or triplicated wiring to provide all-electric control signalling.

The Compagnie Générale de T.S.F. showed the television picture transformer which has been taken up by the American C.A.A. for traffic control purposes.

Hispano Suiza are now producing an emergency ram-air turbine for fighters.

The French Government research agency, O.N.E.R.A., displayed many examples of their research work, including pictures of smoke trials with the Vultur boundary-layer-control wing; the Deltaviex being tested in a large wind tunnel for stability with a pilot aboard; and a series of jet flap experiments. Several companies showed high-altitude sounding-rockets and O.N.E.R.A. displayed a test vehicle which had flown at Mach 2.

Jacottet powered controls are mainly based on a fixed-piston, moving-body principle which allows a continuous mechanical link to be maintained between stick and surface. The valves are also arranged so that there is no flow of oil unless the surface is actually being moved. Power can thus be maintained for much longer after the supply has been interrupted. In case of duplicated supplies, the changeover to the standby system is automatic, and reversion to primary also follows automatically if the supply is re-established. In one case an eccentric weight, rotated at high speed by an electric motor, was mounted close to the jack body to provide a force along the piston axis to relieve friction loads.

Aeronautics at Imperial College

The new Roderic Hill building—opened by the Queen Mother, as recorded on this page—in Prince Consort Road, South Kensington.

FORMALLY opened by Queen Elizabeth the Queen Mother on May 28, the new Roderic Hill Building at the Imperial College of Science and Technology, South Kensington, is now occupied by the College's Departments of Aeronautics and of Chemical Engineering. Following the opening, an opportunity was afforded to members of industry, universities, research establishments, the Press and other friends of the College to inspect the facilities of the fine new building.

The Aeronautics Department is housed in the western half of the Roderic Hill Building, and comprises lecture rooms, library, drawing office, laboratories, a well-equipped workshop and offices for staff and research students. The design of the building is pleasingly appropriate to a University and to 1957—the spacious lecture rooms and staff offices, in particular, will be the envy of many.

Most of the ground floor is taken up by a single large laboratory (165ft × 52ft), half of which is occupied by structural test equipment and half by a 12in × 12in, Mach 2 wind-tunnel (under construction) and its associated air compressors. Outside one wall of the building are the compressed-air storage vessels, four of 550 cu ft and two of 110 cu ft, in which the air is stored at a maximum pressure of 1,000 lb/sq in. Construction of the tunnel itself is almost complete except for the working section.

The structures section of the main laboratory includes, for static tests, a series of structural-test frames based on two 3ft thick reinforced-concrete slabs built into the floor. With these frames are associated powered screw-jacks to apply loads, and equipment for measuring loads, deflections and internal stresses. A 60-ton-capacity fatigue-testing machine can accommodate specimens up to 6ft long, and a special machine has been designed to investigate the buckling of stiffened panels under compression. There is also equipment for vibration tests on structures and components, and apparatus for investigating the structural effects of kinetic heating.

In addition to the various structural demonstrations, the ground-floor laboratory also displayed a Slingsby Skylark 2 sailplane fitted with apparatus for measuring the profile drag of the aerofoil by wake traverse. This aircraft had been used by members of the Imperial College Gliding Club in a series of flight-tests last autumn; further measurements are to be made in which the effect of the wing spoilers will be investigated.

The wake traverse gear comprises small pitot and static tubes, which are moved up and down behind the trailing edge by an electrically driven screw-jack. Pressures, and impulses at 0.2in intervals, are transmitted to a recorder (in which the information is noted by holes made by electric sparks in a strip of black paper) in the cockpit.

A small hydrodynamics section, supplied by water tanks at heights of 15ft and 70ft, also forms part of the main laboratory. In a water channel, streamline and supersonic flow is demonstrated.

A 5ft × 4ft low-speed tunnel, a small supersonic tunnel and the department's workshops are located on the first floor of the building. In the 5ft × 4ft tunnel, which has a speed range from 30 to 160ft/sec, a slender delta wing was mounted for the study of vortex separation. Shock-wave patterns at M=1.8 were observed by means of Schlieren mirrors in the supersonic tunnel, which has a working section of 8in × 2½in. An undergraduate experiment illustrating the distribution of pressure along a Laval nozzle was also on show. An additional 3ft × 2ft low-speed tunnel is under construction.

Further structures and aerodynamics laboratories are situated on the third floor. In one of these a number of small-scale aerodynamic experiments were demonstrated, together with an electronic analogue computor. This laboratory houses a 20in (octagonal working-section) tunnel with a speed range of 0-200ft/sec; flow visualization and simple measurements on a swept-wing half-model were shown. Other exhibits included a model of a hypersonic shock-tube and an investigation of the Coanda effect.

The third-floor structures laboratory contained various simple experiments demonstrating fundamental principles and properties of thin-walled structures.

Head of the Aeronautics Department of Imperial College is Prof. H. B. Squire, with Prof. J. H. Argyris in charge of aircraft structures. At present, about 45 undergraduates enter the College each year for the three-year, B.Sc.(Eng.) course in aeronautical engineering.

There are now also 20 post-graduate aeronautics students at I.C., a number which it is hoped to double during the next three years. The handsome new building—which commemorates the life and service of Air Chief Marshal Sir Roderic Maxwell Hill, Rector of Imperial College, 1948-54, and Vice-Chancellor of London University, 1953-54—is the first to be completed in the College's £15m expansion scheme.

(Left) Structural-test equipment includes this Losenhausen fatigue-testing machine of 60 tons' capacity, capable of accommodating specimens up to 6ft in length. (Right) The air storage plant for the 12in × 12in supersonic tunnel includes four vessels each of 550 cu ft. Maximum pressure is 1,000 lb/sq in.

STUDENTS' PERENNIAL PROBLEMS

By ALAN H. YATES, B.Sc., B.Sc.(Eng.), A.F.R.Ae.S.

SLIPSTREAMS AND CAGE BIRDS

AT a Ministry of Education summer school held at the College of Aeronautics, Cranfield, last year, much discussion was evoked by a talk by Alan Yates to a class of teachers of Aeronautics concerning students' problems. In the belief that the basic factors raised are of interest not only to students but also to more-experienced readers, we are printing two of Mr. Yates' "problems," the first of which appears on this page. The author was an aerodynamics lecturer at the College of Aeronautics for several years before taking up his present position as Principal of Bath Technical College.

WHICH way is the air moving after an aeroplane has flown by? Consider a cubic mile of still air through which an aeroplane passes in steady, level flight. Does the air remain still when the aeroplane has gone? This is a problem on momentum.

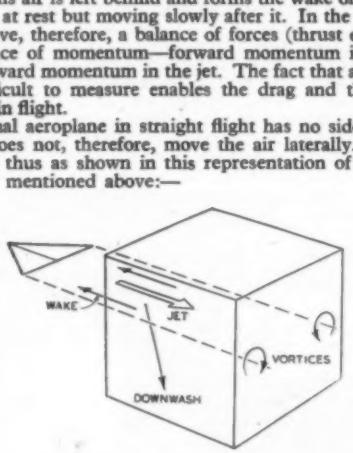
Let us first consider up and down motions. The weight of the aeroplane is supported by its wings, which deflect downwards the air passing over them. The momentum imparted to the air each second is equal to the lift force on the wing. If the aeroplane is flying rapidly, a lot of air is involved each second and the velocity (downwash, as it is called) is fairly small. A slow-flying aircraft of the same weight will leave the air moving downwards at a greater speed. The hovering helicopter, of course, produces quite a rapid downward slipstream. The required amount of momentum is produced either by moving a lot of air slowly or a smaller amount rapidly.

Although the *net* flow of the air is downwards, some of the deflected air is moving upwards! This occurs with any wing of limited span. Only the air passing over or below the wing is deflected downwards. Some escapes sideways from underneath the wing and moves upwards outside the wing tips. These rotary motions of the air behind the tips are known as the wing-tip vortices, and the rotation of the air extends downstream for a great distance. The rate of rotation is greatest near the axis (as with bath-water) and in certain weather conditions these trailing vortices can be seen—and even heard.

Now let us consider air movement in the direction of flight. Whether the aeroplane is driven by a propeller or by a turbojet, the propulsive force is obtained from air discharged backwards —in the slipstream or jet. The momentum per second added to the slipstream is a measure of the propulsive thrust given by the engine.

Why is a thrust needed? To balance the drag (friction) of the air on the surfaces of the aeroplane. The layer of air next to the surfaces is dragged forward, and all the air in a "boundary layer" within about an inch of the surface of a wing is affected in various degrees. This air is left behind and forms the wake of the aircraft —no longer at rest but moving slowly after it. In the direction of flight we have, therefore, a balance of forces (thrust equals drag) and a balance of momentum—forward momentum in the wake equals backward momentum in the jet. The fact that air velocities are not difficult to measure enables the drag and thrust to be determined in flight.

The normal aeroplane in straight flight has no sideways force on it and does not, therefore, move the air laterally. The total motions are thus as shown in this representation of the "cubic mile of air" mentioned above:—



What happens to this air which has been set in motion by the passage of the aeroplane? It represents kinetic energy going to waste, originally supplied from the fuel and eventually dissipated as heat in the atmosphere. This waste can be minimized by good design: careful streamlining will reduce the size of the wake, and thus the thrust required from the jet. The downward momentum is decided by the weight, but the kinetic energy involved is minimized if as large a volume of air as possible is deflected. That is why large spans and high speeds reduce this "induced drag" as it is called. That is also why a helicopter is operating inefficiently while hovering and can reduce power once it moves forwards and influences more air. The strength of the vortices, and the energy wasted in them, also diminishes if the aeroplane's speed and span are increased.

The downwash eventually reaches the ground, where its downward momentum is destroyed. The force exerted on the ground by the impinging downwash is equal to the rate at which momentum is destroyed. We have already said that the rate at which it is created is equal to the aircraft weight, so that we find a force on the ground equal to the weight of the aircraft. We are not usually conscious of an increase in air pressure as the aeroplane flies over, because the increase is small. If the aircraft is flying supersonically, however, the sudden jump in air pressure as it passes may break windows and be heard as a "sonic bang."

This consideration of the motion of the air is a valuable illustration of the concepts of momentum and energy.

Cage Birds. We can apply these principles to the solution of some well-known puzzles. Imagine a bird at rest on a perch in a very large bird-cage made throughout of very-fine-gauge wire. The whole is suspended from a spring balance and weighs, say, 10 lb. The bird then takes off and flies round the cage. Does the reading of the spring balance alter? Would the answer be the same if the cage had a solid floor?

The weight of the bird is no longer being supported by the reaction of the perch, which was included in the ten pounds recorded by the spring balance. The reading will thus fall by the weight of the bird. The bird must now impel air downwards and generate momentum by flapping at a rate equivalent to its weight. If the cage has a wire base, this air moves down out of the cage without hindrance. If, however, the base is solid, then the momentum is destroyed and a downward force equal to the weight of the bird is added to the weight on the spring balance: clearly it now reads 10 lb again.

The answer to the problem is, therefore, that the reading of the spring balance changes only if the floor of the cage allows air to pass through it—or round its edges if it is small.

(FISH-TAILPIECE: *A goldfish cannot avoid transferring his weight to the bowl in which he swims. If his density is not the same as that of the water, the load on the bowl is the same whether he swims or lies on the bottom.*)

FORTHCOMING EVENTS

June 5-7. Institute of Navigation: "Avoidance of Collision by Shipborne and Airborne Means," a Three-day Conference in conjunction with the French and German Institutes.
June 8-10. Fréjus-St. Raphael Aero Club: 4th International Rally, Fréjus.
June 9-10. Austrian Aero Club: International Rally, Vienna/Aspern.
June 9-10. British National Model Aircraft Championships, R.A.F. Waterbeach.
June 9-10. Leinster Aero Club: Annual Display, Weston Airfield, Dublin.
June 9-16. Western France Aero Club: Angers Gliding Week, Angers.
June 10. Royal Aero Club: Aerobatic Competition, White Waltham.
June 10. Royal Dutch Aero Club: 6th International Air Display, Ypenburg.
June 13. Aerodrome Owners Association: Forum on Helicopter Landing Sites.
June 15. Northampton Gliding Club: Open Day, Sywell.
June 15-16. Lower Normandy Aero Club: 10th International Rally, Flers.
June 15-17. Le Zoute Aviation Club: Invitation Rally.
June 17-20. I.A.S.: National Summer Meeting, Los Angeles.
June 17-29. Institute of Welding: British Commonwealth Welding Conference, London and Saltburn-by-the-Sea.
June 19. Kronfeld Club: Film Show.
June 21-24. Palermo Aero Club: 9th International Aerial Tour of Sicily, Palermo.
June 24. F.A.I. Annual Conference, Palermo.
June 26. Kronfeld Club: "The R.A.F. Formation Squadron," by S/L. Topp.
June 29-30. Invitation Rally, La Baule.
July 5. Tiger Club: Aerobatic Contest, Sywell.
July 12-13. Royal Aero Club: National Air Races, King's Cup, and Lockheed Aerobatic Trophy, Baginton.
July 14. Yorkshire Aeroplane Club: At Home, Sherburn-in-Elmet.
July 14. Wolverhampton Aero Club: Invitation Rally.
July 27-Aug. 5. National Gliding Championships, Lasham.
Sept. 2-8. S.B.A.C. Show, Farnborough.

ASKED . . .

AT the end of Tolcarne Drive, Pinner, Middlesex, stands a group of flat white single-storey prefabricated buildings which look for all the world like Government offices—and, in fact, are. Close by runs the main Marylebone-Sheffield railway line; near at hand is Northwood Hills station on the "Met"; and at the gate of the prefab buildings are two neat notices. One says "Inland Revenue" and the other "Ministry of Transport and Civil Aviation." A passing stranger, loitering towards the laburnum and flowering currants which make this suburban drive sweet-scented in springtime, might assume that the difference between these two Government offices was merely one of function, and that each displayed an indifference towards the general public except through recognized channels of inquiry.

Such a view (and here one speaks without casting aspersions upon the Inland Revenue, who are doubtless the soul of kindness in extracting one's schedule A) would certainly not be true of the M.T.C.A. office in Tolcarne Drive, which houses the Aeronautical Information Service; for the A.I.S. is a Government department which imbibes and disseminates aeronautical information from the four corners of the world, and in doing so maintains an unusually refreshing view of public relations.

Their uncomplicated attitude towards aeronautical queries probably springs from the fact that their chief and senior officers are ex-R.A.F. pilots and know from experience what the customer—be he airline operator, private pilot, aeronautical writer or anyone else—really wants. These men, with their first-hand knowledge of practical flying, have built up an organization which can supply any sort of aeronautical information in the shortest possible time. Thus, if you ask for the state of the airfield at Fort Lamy in French Equatorial Africa, the A.I.S. comes up with its serviceability state almost immediately; or if the *Encyclopædia Britannica* compilers wish to check whether La Paz in Mexico and Jericho in Jordan are still the highest and lowest airfields in the world, the same well-ordered and up-to-date filing system supplies an immediate answer.

It would be incorrect to give the impression that the whole of the A.I.S. is located at Pinner. Its headquarters and information-disseminating organization is there; but it has three area-centres, at Uxbridge* and at Manchester and Prestwick airports; there are A.I.S. aerodrome units at London Airport North and Central, Prestwick and Manchester, all staffed by ex-aircrew briefing officers; and there are "D" units at smaller airfields.

In its present form A.I.S. is a young organization, deriving from the Convention on International Civil Aviation held at Chicago in 1944. (There had been an organization of similar kind in pre-war years, and at Pinner a fascinating scrapbook contains some of its documents, including the log of the R.34's Atlantic crossing in 1919 and a typical visual-flying briefing on cross-Channel routes for pilots flying from Croydon to the Continent in the 1920s.)

Between 1944 and 1953 the idea of an A.I.S. was developed and clarified successively in 1946, 1949, 1951 and 1952; until in 1953, when Annexe 15 to the Convention of International Civil Aviation was published, a standard of uniformity was established for the "collection and dissemination of aeronautical information in the interest of the safety, regularity and efficiency of international air navigation." Each I.C.A.O. contracting State is required to provide an A.I.S. for its own territory (on its own or in conjunction with another country), and to be responsible for the collection, collation, editing and publication of such information in an adequate and accurate manner.

There are two kinds of A.I.S. information. That of a permanent character is included in *Air Pilot (United Kingdom)* published by the Ministry; while information of a temporary nature about local changes or hazards, which must be known quickly, is disseminated in the form of *Notams* (Notices to Airmen).

An example of each kind should illustrate the difference. The details of the U.K. Airways system included in the *Air Pilot* is information of a permanent character; a *Notam* saying that work is in progress on a runway at Stansted is a temporary local

** This area-centre is moving to London Airport in the near future. The two photographs on this page were taken at the information unit at London Airport.*

THE M.T.C.A. AERONAUTICAL INFORMATION SERVICE: ITS WORK FOR CIVIL AVIATION

. . . AND ANSWERED

change; and one about a captive balloon at Reading informs pilots of a temporary local hazard.

The A.I.S. is part of the Control and Navigation Directorate of the M.T.C.A., and it is sub-divided into A.I.S.1 (the U.K. section) and A.I.S.2, which covers overseas areas. A.I.S.1 is itself sub-divided into 1a and 1b, the latter dealing with *Notams* Class I, information for which is received and repromulgated by teleprinters when addressees cannot be reached in time by post. Summaries of effective Class I *Notams* are published monthly, and a daily summary of air navigational warnings within the U.K. is sent to all A.I.S. units. These duties are covered by briefing officers who work on a 24-hour-watch system and also by filter assistants by day. Like that famous little theatre near Piccadilly Circus, A.I.S.1b "never closes."

A.I.S.1a is responsible for the *Air Pilot*—a complete compendium of civil aeronautical information, kept up to date by monthly supplements—which includes all information on U.K. aerodromes, telecommunication facilities, navigational hazards, procedures and regulations (the area of this information including the Channel Islands and the Isle of Man). It also publishes U.K. *Notams*, Class II, which are issued weekly. The *Air Pilot* is intended "to meet the needs of those engaged in flying operations"; information for it is received from the policy branches of the M.T.C.A., and this is collated, edited and prepared for the printers by A.I.S.1a. The total number of copies of the *Air Pilot* and Class II *Notams* despatched for home and overseas use is 3,300. Constant liaison with broadcasting, television, electricity and local authorities on the notification of obstructions is another part of A.I.S.1a's work. The branch is also responsible for publishing details of royal flights like that made in April by the Queen and Prince Philip to France; and a permanent wall display at Pinner—and similarly at A.I.S.

ASKED . . . AND ANSWERED . . .

area centres, aerodrome units and "D" units—shows all aerodromes in the U.K. which are active (depicted according to types), the Airways scheme, F.I.R.'s, danger areas, etc.

A glance at this wall display, with its spider's web of multi-coloured pin-heads on maps of Britain, shows how complex is the information A.I.S. maintains on only one aspect of aviation—aerodromes. Here are marked the varied types of landing-ground—civil Customs, non-Customs, military, master diversion, helicopter, unrestricted (except for weight), prior permission only, charter only, scheduled service only, normal scheduled services plus some prior permission charter flying. Types of runways and landing areas are also shown; and all these airfields are docketed on a card-index system as efficient and detailed as criminal records at Scotland Yard, and as persistently brought up to date. A similar method, even more impressive in size, is maintained for overseas landing-grounds listed in the files of A.I.S.2.

All the information obtained by A.I.S. headquarters is supplied to its aerodrome units and "D" units. Thus aircrews requiring briefing find not only briefing officers ready to answer their questions but an abundance of up-to-date information readily available, and in addition local let-down charts, an Airways map of Europe, sunrise and sunset tables, the serviceability states of aerodromes, and much other information.

Another aspect of A.I.S. work (and one in which it takes particular pride) is the training of foreigners, who then go back to run similar aeronautical services in their own countries. Since 1955 such trainees—some of them on I.C.A.O. fellowships, some coming under the *aegis* of the Colonial Office, some sponsored by their own governments—have visited Pinner from the Philippines, the Lebanon, West Indies, Spain, Kenya, Syria, India, Afghanistan, Japan, Ethiopia and Finland. A.I.S. officials make it clear that they welcome visitors to Tolcarne Drive at any time, whether from Persia or Paisley, Morocco or Manchester.

One of many interesting things to be seen at A.I.S. headquarters is the teleprinter room, the channel by which all *Notams* Class I (national and international) are received. Through its machines—just as in a newspaper office—the A.I.S. gets news a few minutes after it has happened. If a runway goes out of use at Orly or if Idlewild puts out a warning that night-flying equipment on one of its runways is unserviceable, this information is passed to A.I.S. centres within minutes for briefing the next outbound crews.

Thus the unpretentious white offices at Pinner are a hub of world-wide aeronautical information. Whatever affects flying operations, whether restrictions on landing or hazards *en route*, is known here and published to all concerned.

Airline and charter pilots, ferry crews and club pilots—in fact everyone concerned in aviation—benefit from the service; yet it is done with such modest efficiency that people at the receiving end, reading the *Air Pilot* or studying the latest *Notams*, may think all the information assembles itself automatically. To realize how much work is involved in publishing it in tabulated, easily understandable form it is only necessary to spend an hour or two in any of the A.I.S. units. Having done so, it is pleasant to put on record here the gratitude of everyone concerned in aviation to the A.I.S. officials at Pinner and elsewhere for what might be termed—with a pardonable pun—their absolutely invaluable services to aviation.

H. W.

PILOTLESS TEMCO

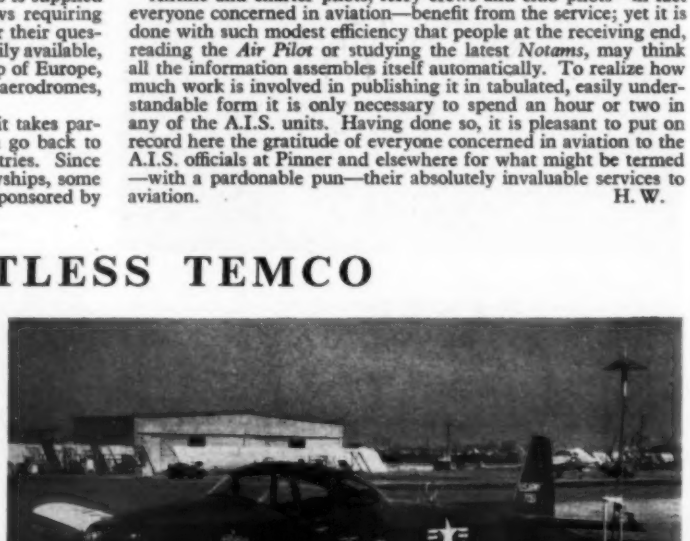
IN the photograph is seen a Temco L-17 now being used by the U.S. Army Signal Corps as a drone for evaluating the performance of photographic and TV cameras in "surveillance missions."

The system consists of (a) an L-17 aircraft modified by its makers for the purpose and incorporating an autopilot which provides effective out-of-sight remote control of the drone by means of on-off radio signals, and (b) a compact ground-control station which may be transported in a jeep.

A standard L-17 was first flight-tested to determine its exact response to controls; basic design for the drone system was completed; off-the-shelf autopilot components were selected and ordered; and the prototype was fabricated.

The modified L-17 may be used as a ground-operated pilotless aircraft, or it may be flown by a safety pilot who can at will operate the aircraft himself or turn command over to the ground controller. Signals transmitted from the ground to the 42-lb autopilot unit control stability, altitude and airspeed. The aircraft will perform a programmed climb or glide, and automatically operating relays prevent stalls, overspeeding, excessive loss of altitude or other hazardous conditions.

At the completion of a flight the ground controller operates an "approach" switch which positions landing gear, flaps, propeller pitch and power in proper sequence; then he directs the landing.



The Temco L-17 drone with its various airborne "black boxes." On the right are the compact, easily transported ground-control unit and aerial.

SEAMASTER ACCIDENT EXPLAINED

REASONS for the loss of the second Martin P6M SeaMaster prototype last November have been given by the manufacturers. It appears that the tailplane actuator jack was overpowered by aerodynamic loads when, during a series of special vibration checks, the elevators were locked for test purposes and horizontal control was being provided entirely by the fully powered tailplane. (The elevators are normally deflected upwards for trimming during high-speed flight.)

Immediately before the accident the pilot put the P6M into a shallow dive at 25,000ft and pulled out at 20,000ft. The aircraft then became uncontrollably tail-heavy, performed a tight loop, and, after several violent manœuvres during which all four occupants managed to eject safely, it dived earthwards and broke up at about 5,000ft.

It was discovered in subsequent investigations that, with the elevator locked, the tailplane hinge moments came close to exceeding the actuator capacity at speeds in the region of that attained at the time of the failure. A slight disturbance was sufficient to overload the jack completely, making it impossible to prevent the aircraft assuming a progressively nose-up attitude. The onset of this condition was not noticed by the pilot because of the irreversible, fully-powered control system. The Martin Company do not think that earlier tests and calculations could have indicated accurately the possibility of such a control failure.

INERTIAL SYSTEM FLIGHT-TESTED

A NEW inertial navigation system has been flight-tested with a DC-3 in the Minnesota and Wisconsin area by Minneapolis-Honeywell Regulator Company. Designated I.S.I.P. (Inertial System, Indicating Position), the equipment utilizes accelerometers measuring accelerations in the north-south and east-west directions.

Only a small number of these systems has so far been manufactured, but Minneapolis-Honeywell state that they are in production with some of the main components—presumably the precision gyroscopes required for the stable platform. The company is setting up a special inertial-guidance establishment at St. Petersburg, Florida.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Royal visit to the Home Fleet: the scene aboard "Ark Royal" as the Queen and the Duke of Edinburgh drove between the lines of Sea Hawks. In the background are Gannets, Wyverns and a Skyraider. The small inset picture shows the excellent representation of the Royal Cipher flown by 21 Sea Hawks and six Wyverns to welcome Her Majesty home from Denmark.

The Queen aboard "Ark Royal"

ON the third day of the three-day visit which the Queen and the Duke of Edinburgh paid to the Home Fleet in Cromarty Firth on their way home from Denmark last week they went on board H.M.S. *Ark Royal*. Earlier they had visited *Albion* and *Ocean*.

The Queen, who was accompanied by Admiral Sir John Eccles, C-in-C. Home Fleet, was received by Vice-Admiral M. L. Power, Flag Officer Aircraft Carriers, and Captain F. H. E. Hopkins, captain of *Ark Royal*. After the royal visitors had inspected the carrier's equipment and met a number of the aircrews, *Ark Royal* moved out into the Moray Firth and flew-off eight Sea Hawks, followed later by 14 more Sea Hawks, four Wyverns, four Gannets and two Skyraiders.

A rocket attack was made by the Sea Hawks on a towed target, Wyverns attacked with cannon fire, and Gannets dropped depth-charges; Skyraiders demonstrated early-warning operations; and a helicopter rescue was staged.

After rejoining the royal yacht *Britannia*, the Queen sent the following signal to Flag Officer Aircraft Carriers and to *Ark Royal*: "I thoroughly enjoyed this morning's carrier demonstration and I was most impressed by the enthusiasm and efficiency of all hands. I send you all my best wishes for a happy and successful visit to the United States."

On her return from Denmark three days before, preparatory to the Fleet visit, *Britannia* had been met and escorted by Sea Hawks and Wyverns. It was on this occasion that the pilots flew the royal cipher formation illustrated above.

Gruenther Trophy

ON May 24 the 2nd A.T.A.F. (British, Belgian, Dutch) won the Gruenther Trophy, an annual award—donated by Republic Aviation—for proficiency in photo-reconnaissance among Allied Air Forces Central Europe. Last year the 4th A.T.A.F (U.S., French, Canadian) were triumphant; at this year's four-day meeting at Laarbruch the overall scoring was: 2 A.T.A.F., 796½ pts; 4 A.T.A.F., 575½.

In the absence of the team leader, F/L. D. A. Winterford (2 Group) S/L. Wrigley accepted the Trophy from Gen. Jean Etienne Valluy, C-in-C. Allied Forces Central Europe. Winner of the permanent squadron aircrew award (low-level events), donated by Vickers-Armstrongs, went, appropriately, to a Swift F.R.5 pilot, F/L. A. D. Laurence (79 Sqn.). The Glenn Martin award (high-altitude) went to F/Os. H. S. Thompson and W. T. Bowden (17 Sqn.), who flew a Canberra P.R.7 (another appropriate award since Martin make a similar machine). In addition, all air and ground crews of 2nd A.T.A.F. received an individual silver plaque presented by Republic.

At the presentation and static display, held in 31 Squadron's hangar at Laarbruch, the 2nd A.T.A.F. Commander, Air Marshal the Earl of Bandon, welcomed 50 distinguished visitors, including 20 NATO generals.

During her visit to R.A.F. Station Benson last week the Duchess of Gloucester—in uniform as Air Chief Commandant of the W.R.A.F.—visited the N.A.A.F.I. families' shop. Among those in attendance were W/C. D. P. Marvin (left) and G/C. H. J. Hobbs, the Station Commander.

U.A.S. Summer Camps

THE university air squadrons begin their summer camps this week-end (June 9), when St. Andrew's U.A.S. goes to R.A.F. Station Ouston, Durham, to stay until June 23.

For the first time a university squadron will camp at a Royal Naval air station—Oxford U.A.S. will go to Culdrose from June 23 to August 3.

In addition to the camps for pilots and navigators, the three Fighter Control Flights (from Oxford, Cambridge and London University) will go to separate camps; dates and stations will be: Oxford, June 23 to August 3, R.A.F. Sopley, Hants; Cambridge, June 22-July 20, R.A.F. Hack Green, Cheshire; London, June 29-August 10, R.A.F. Hack Green.

We hope to give further details of summer camps in a forthcoming issue.

Performing at Paris were the superb aerobatic team of 111 Sqn., led by their C.O. S/L. Roger L. Topp (centre of group). Their black-painted Hunter 6s are powered by late-series Rolls-Royce Avons, like those fitted to the Vickers Supermarine Scimitar (right). The Scimitar's hinged nose, here shown opened for access, will house powerful airborne radar. The tail (extreme right) belongs to a Mirage.

SERVICE AVIATION . . .

Royal Birthday Fly-past

ON the official birthday of the Queen —Thursday next, June 13—Her Majesty will watch from the balcony of Buckingham Palace a fly-past by nine Valiants flying in three formations at 1,000ft. Leaders will be W/C. A. H. C. Boxer (O.C. No. 7 Sqn., Honington), W/C. R. E. Havercroft (O.C. No. 543, Wyton) and W/C. F. C. D. Wright (O.C. No. 148, Marham). The fly-past will be at 1300 hr, or at 1700 hr should the Trooping of the Colour ceremony be postponed owing to bad weather.

The R.A.F.A. Conference

THE annual conference of the Royal Air Forces Association was held last week-end at Torquay, with Marshal of the Royal Air Force Lord Tedder as chairman.

From the agenda it was obvious that finance is the association's greatest immediate problem. The problem is in two parts: Firstly, some degree of reorganization will be necessary in order to effect important economies in administrative expenditure; secondly, arrangements will have to be made for the wisest allocation of money from the welfare fund, which has benefited from the success of Wings Day appeal and cinema collections.

In his speech at the conference, Lord Tedder dismissed as "pure fantasy" the idea that the R.A.F. would soon become a service in which "we are all going to sit in dug-outs and push buttons." There were going to be military aeroplanes for as far ahead as we could see.

He expressed this view in an endeavour to reassure delegates who had unanimously supported a resolution instructing the Association's national council to examine the employment services of the organization "to ensure that the maximum assistance be given to all ex-R.A.F. and W.R.A.F. personnel in the event of redundancy becoming a national problem."

A report of the conference will appear in a forthcoming issue of *Flight*.

Valiant Pilot Cleared

AT a court-martial at R.A.F. station Wyton last week, S/L. K. H. Letford, D.S.O. and Bar, D.F.C. and Bar, was cleared of a charge of negligence in causing damage to a Valiant. It was stated in evidence that, whilst taxying, the aircraft damaged a wing-tip against an extensible servicing ladder which swung round as a result of the engine noise. The court agreed that there was no case to answer.

The Air Ministry has announced that sentence of 12 months' imprisonment and cashiering, passed by a Cyprus court-martial on a Canberra captain found guilty of damaging his aircraft to avoid carrying out a mission during the Suez operations, has been reduced to one of six months' imprisonment and cashiering.

Another fine impression of the royal visit to the Home Fleet: looking across Gannets ranged on the flight deck of H.M.S. "Albion," it shows the royal yacht "Britannia on the port quarter and H.M.S. "Ocean" astern. Both carriers took part in last year's Suez operation.

Lockheed's ultimate in four-engined piston transports: the 150ft span L.1649A Starliner. "Jetstream" is the name given by T.W.A. to the aircraft and also to the mixed-class coast to coast U.S. services and the 74-seat transatlantic tourist services which were inaugurated on June 1. An initial eight return flights a week between London and New York will increase to ten a week in July.

CIVIL AVIATION

BRITANNIAS FOR CUBANA?

AN American source reports that Cubana are to buy two Britannias. The aircraft would be delivered in 1958 and used on the airline's routes from Havana to New York and Madrid. This is the second report of intended purchase by a Central American airline; Aeronaves de Mexico are understood to have on order two Britannia 302s, which they will use between Mexico and New York. Neither of these orders has yet been confirmed.

Cubana already have turboprop experience. They operate three Viscount 755s and have four Viscount 810s on order; the remainder of their fleet consists of L.1049Gs, two Constellations and six DC-3s.

FORWARD SCATTER

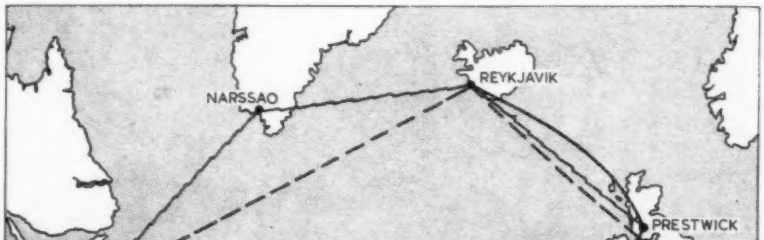
COMMUNICATIONS across the North Atlantic are still one of the biggest stumbling-blocks to efficient air traffic control. The auroral regions, it must be accepted, are not the most suited to radio communications over long distances, and sooner or later bottle-necks occur because transmissions become "blacked out."

This is the problem that faced the I.C.A.O. Special North Atlantic Fixed Services Meeting in Montreal: to devise ways of improving the certainty of communication between ground control points and between aircraft and the ground. The results of their deliberations were surprisingly clear-cut and unusually encouraging. They were able to reach a promising solution to the communications problem and they pushed a plan for its implementation to the limit of their terms of reference.

The meeting concluded that the U.S. plan for using a "V.H.F. forward scatter communications system" as a solution to the fading of communications between control points (I.C.A.O.'s "fixed services") should be recommended for implementation. As a result of successful trials over a period of several years three links are envisaged: one between Newfoundland and Greenland, a second between Greenland and Iceland, and a third between Iceland and the United Kingdom and Ireland; all of which would be integrated and would provide four teletypewriter channels and one telephone channel between the points served by the system. The meeting's alternative proposal to the link between Iceland and the United Kingdom and Ireland is an undersea cable telephone-telegraph communications channel that could be integrated with the forward-scatter system between Iceland and North America.

In contrast to North Atlantic black-outs of an hour or more associated with conventional radio communications systems, the performance expected of V.H.F. forward scatter is of a high order: a telegraphy error-rate not exceeding one character in a thousand in more than one per cent of the total ten-minute intervals during the year; and a single-link telephony service reasonably adequate 99 per cent of the time and satisfactory for at least 90 per cent of the time.

(The V.H.F. forward scatter system operates in the V.H.F. band between 30 M/cs and 60 M/cs, using highly directional antennae and relatively large (50 to 100 kW) transmitter towers. Forward scatter does not depend upon reflection from the ionosphere in the normal manner but upon a relatively constant scatter, much as fine dust scatters in the light from a searchlight. Two frequencies—one of about 40 M/cs and the other in the neighbourhood of 55 M/cs —have been chosen as available alternatives so that reflection of the signals by the ionosphere can be kept to a minimum.)



The proposed point-to-point communications systems for the North Atlantic. The dotted lines show high-frequency radio teletype; solid lines undersea cables; and stepped lines V.H.F. forward scatter.

MERCHANT VENTURER

SPECULATION was aroused about a T.W.A. order for the Caravelle when, last week, the aircraft touring America departed from schedule to visit Los Angeles. A Press demonstration flight between Kansas City and Chicago was cancelled in favour of a flight to the west coast for a "personal inspection" by Mr. Howard Hughes, and it was reported in Chicago that T.W.A. (through the Hughes Tool Company) was "on the verge of placing a substantial order for Caravelle jet transports."

T.W.A. already have an unusually varied fleet (28 L.1049G, nine L.1049A, 71 Constellation, 10 DC-4, five DC-3, 11 Martin 2-0-2, 37 Martin 4-0-4 and one Fairchild C-82) apart from 25 L.1649A "Jetstreams" now being delivered, and eight Boeing 707 and 30 Convair 880s which are on order. Last week we reported their interest in the 15 "off-the-peg" ex-Capital Viscounts.

To obtain an order before departure would crown the Caravelle's successful tour. Up to the time the aircraft left Miami on May 20 it had made 51 flights in the Americas totalling 81 hr 56 min. Demonstration flights had been given to sixteen airlines and 1,419 people had been carried. The only departure from schedule was at Caracas, where a "technical detail" caused a 15-minute delay. Sud Aviation say that across the U.S. the aircraft continues to excite "astonishment, interest and admiration."

It is reported that since the Caravelle's recent tour of South America orders have been placed by Varig and by the Argentine Government. These reports could not be confirmed by Sud Aviation in Paris last week.

CIVIL AVIATION . . .

TOO MANY AIRCRAFT FOR B.O.A.C.?

WE have already noted that B.O.A.C.'s £195 million commitment to new aircraft exceeds by a very large amount that of any other world airline. It is nearly double that of PanAm, who are the second most heavily committed (about £100 million). B.O.A.C. have on order 18 Britannia 312s, 19 Comet 4s, 15 Boeing 707s, and—as announced on May 22—35 Vickers VC-10s.

How will all this capacity match up to traffic? The order for 35 Vickers VC-10s alone represents a very large amount of capacity—equivalent to about three times that of B.O.A.C.'s total fleet in 1956. The VC-10 fleet may not be in full service until 1965; but add the traffic potential of the other aircraft on order and it appears that, even assuming a truly prodigious increase in business, the Corporation will have too much equipment on its hands in 1965.

The revenue traffic carried by B.O.A.C. last year amounted to about 164 million short-ton-miles. From now on the Corporation will be most competitively equipped, and its traffic should expand at least at the same rate as the world average, which is about 15 per cent per annum. At this rate, traffic in 1965 will be about 575 million ton-miles.

To carry this traffic, assuming a load factor of 60 per cent, a capacity of 960 million ton-miles will be required. How much will in fact be available?

Assume that all piston-engined equipment, including DC-7Cs, is retired by 1965. Assume also that the 15 Britannia 102s will have been disposed of by then. Capacity of each fleet is therefore as follows:

B.O.A.C.'s Capacity in 1965

Fleet	No.	Unit P'load (short tons)	Block speed (m.p.h.)	Utilization (hr.)	Capacity ton-miles
Boeing 707	15	19	480	3,000	410m
Vickers VC-10	35	15*	480*		760m
Comet 4	19	10	420		240m
Britannia 312	18	14	310		235m
		* Estimates only			Total: 1,645m

This is 70 per cent too much capacity, and still too much without the Britannia 312s and Comet 4s.

It seems highly unlikely that B.O.A.C. can count on a 20 per cent annual rate of traffic-increase up to 1965; but even assuming this, Britannia 312s and Comet 4s would still have to be disposed of to avoid excess capacity.

The conclusion seems clear: B.O.A.C. must be planning on an all-jet fleet of 707s and VC-10s. And they appear to be counting on big increases in traffic to fill them.

Even more illuminating is a matching of B.O.A.C.'s traffic and capacity in 1962. If traffic grows at the average world rate, B.O.A.C. will find themselves with 35 per cent too much capacity —even assuming that all Britannia 102s and DC-7Cs are sold by 1962. And the Corporation may still have too much capacity in 1962 even if a higher (20 per cent) annual increase in traffic is achieved between now and that date.

Malayan Airways last month celebrated their tenth anniversary. Their fleet consists of eleven DC-3s—one of which is shown here—and three D.H. 89s; between them they flew almost 24,000 hours in 1956.

TAPPING THE TRAFFIC

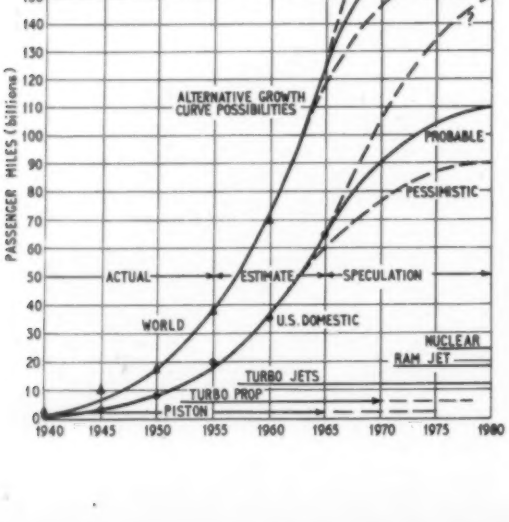
WHAT justification is there for those engaged in air transport market research to assume that traffic will increase at a higher or at a lower rate than in the past? And what will be the effect of reduced air fares upon traffic growth? Will there ever be saturation of the market?

These are questions which everyone interested in the future of commercial aviation is asking; and they are questions which Dr. Theodore P. Wright, vice-president of Cornell University, has been studying, as readers of the American journal *Aeronautical Engineering Review* will have noted.

Dr. Wright has a theory that the potential market for passengers increases inversely as the cube of the fare. Thus, if the size of the available market, say in the U.S.A., is 10 million people, all of whom could fly today at an average fare of 5.34 cents per passenger-mile, the rule states that if fares were to be dropped to 3.31 cents (present U.S. first-class rail fares) then the potential market would expand to 42 million people. Obviously, reduction of the fare to zero on this hypothesis would mean that the whole population would fly, which is absurd; but again taking the case of the U.S. domestic market Dr. Wright assumes that the point of diminishing returns, or saturation, would begin to occur at about 50 million persons, which is about 30 per cent of the U.S. population. A reduction in fares to 2 cents per passenger-mile (bus rates) might perhaps mean a potential of 100 million people rather than the entire U.S. population.

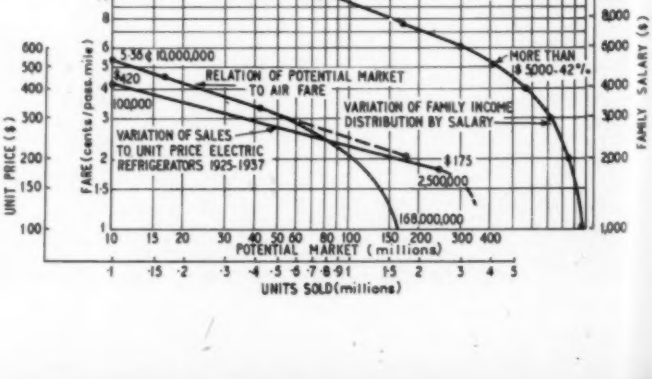
He illustrates his law in the graph reproduced below. The upper curve indicates the measure of the public's ability to pay, and roughly parallels the curve of air fare *versus* market potential. He shows also a plot of household refrigerator prices *versus* sales from 1925-37, which followed the same "inverse cube" relationship.

Dr. Wright makes, too, a forecast of the growth of air transport up to 1980. This is illustrated in the other curve. He says that all developments—in business, transport or what you will—advance along such a classical growth curve. Starting slowly, progress passes through a long steady period, then tapers off. Dr. Wright's curve shows us now near the middle of the steep ascent.



(Left) A forecast by Dr. T. P. Wright—see column above—of alternative growth possibilities of world and U.S. domestic air traffic.

(Below) The law of diminishing returns applied to air transport. Generally, commodity price and potential market follow an approximate inverse-cube relationship, which must to some extent be related to the public's income (upper curve). The vertical scale is logarithmic.



PRACTICAL STATISTICS

LAST year the U.S. scheduled airlines accounted for just over 61 per cent of the world's passenger traffic, and their combined fleets totalled 1,726 aircraft. Yet so fine has the balance been struck between traffic growth and spiralling costs that—if fares are to be held to their present level—a constant search for more efficiency is required in order to maintain even a slender profit margin.

The table (right), condensed from fiures published in *American Aviation*, is a digest of the economic performance of the aircraft operated by U.S. scheduled airlines. The figures are the *average* of all operations; there is frequently a considerable spread between the best and worst figures achieved. Load factors, for example, are found to vary as widely among local service operators as between feeder services and major trunk routes. The same is true of block speeds, which vary between carriers and between different operations by the same carrier. It is a remarkable fact that the block speeds shown here are lower than those recorded for 1955. The biggest drop occurred among aircraft operating in high-density areas such as New York, Washington and Boston—statistical evidence of the economic penalty of the air traffic control problem.

Aircraft	1956 D.O.C. (cents per a/c mile)	Change from 1955 (per cent) (*a*)	Maintenance (cents. per flying hour)	Change from 1955 (per cent) (*a*)	Av. and (max.) seating	Av. blk. speed (m.p.h.)	Av. load factor
Douglas:							
DC-3	51.89	—	17.53	−2	25 (31) (*e*)	149	50.1
DC-4	93.9	+15	47.79	+6	57 (70)	189	62.5
DC-6	93.41	−6	60.39	+6	56 (80)	255	64.1
DC-6A	111.51	—	56.58	N.A.	N.A.	256	N.A.
DC-6B	110.47	−6.2	59.56	+16	68 (94)	247	63.6
DC-7	126.91	+2.8	96.83	+1.25	64 (89)	296	67.2
DC-7B and C ...	149.14 (*b*)	—	74.92 (*b*)	—	42 (44)	288	65.1
Convair 240/340 ...	79.40	—	48.04	—	42 (44)	199 (*f*)	59.2
Curtiss C-46/CW20T	81.61	(*c*)	30.53	(*c*)	N.A.	184	49.4
Lockheed:							
L.49	136.39	(*d*)	101.9	(*d*)	66	288	56.3
L.649 and 749 ...	106.6	−4.2	71.66	+5.7	N.A	240	59.1
L.1049	110.71	−19.2	87.78	+15.6	79 (88)	257	63.1
L.1049C	155.5	+7.2	99.01	+27	77 (88)	253	61.9
L.1049G	190.91	+5.7	86.79	+30.1	72 (83)	249 (*g*)	57.9
Boeing 377	158.42	−8	98.64	+4.4	46 (48)	254	64.0
Viscount	75.8	(*c*)	34.45	(*c*)	39 (40)	246	63.0
Martin 2-O-2	86.29	+3.7	38.96	−17.8		180	51.6
Martin 4-O-4	84.88	−1.7	42.23	+15.8		186	

Footnotes. (*a*) Changes of less than one per cent are ignored. (*b*) Early operations. (*c*) First full year. (*d*) Declining operations. (*e*) Not including versions with less than 21 seats. (*f*) Includes Convair 440. (*g*) Includes L.1049H. N.A.: Not available or not applicable.

INCREASED COSTS—SAME FARES

LAST week the Civil Aeronautics Board confirmed its earlier tentative judgment and rejected I.A.T.A.'s proposed five per cent increase in transatlantic fares.

"Evidence available," the Board said in its decision, "supports our repeatedly expressed view that the current level of North Atlantic fares, which exceeds the domestic level by approximately 70 per cent, may be unreasonably high"; and to the contention that costs had increased it replied that "price increases in major cost components over recent years have not been reflected in a corresponding increase in the unit cost of operation upon which the fare is based."

This decision is likely to be contested by I.A.T.A.; we recorded last week Sir William Hildred's views on the increased landing charges in the U.K. Since then I.A.T.A.'s director has taken up his cudgel again. "The airlines," he said, "are subject at any time to arbitrary increases in landing fees, and unfortunately without regard to the fact that they are tied to a scale of earnings which some governments are most reluctant to change." These increases were "unhappily typical" of the many small factors of rising costs. He forecast that "If the trend continues it will cripple the air transport industry at the very moment it faces its greatest venture yet into . . . low priced mass transport and its heaviest capital investment yet to meet the jet age."

SWANSEA AIRPORT OPENED

THE inauguration of Cambrian Airways' scheduled passenger service between Swansea and the Channel Islands coincided with the official opening of Swansea Municipal Airport on Saturday last, June 1. Civil notabilities from Jersey and Guernsey arrived by Heron and were received by the Mayor of Swansea, Councillor A. E. Harries, J.P., after which G/C. Douglas Bader, C.B.E., D.S.O., D.F.C., declared the terminal building open.

At a luncheon given by the Mayor in Swansea Guildhall after the ceremony, speeches were made by Councillor T. W. Davies, J.P.; G/C. Bader; Mr. S. Kenneth Davies, C.B.E.; Councillor Percy Morris, M.P.; Councillor W. T. Mainwaring Hughes, Deputy Lieutenant of Glamorganshire; Mr. R. H. Johns, C.B.E., Chairman (Guernsey Delegation), Channel Islands Air Advisory Council; Senator W. H. Krichefski, chairman of the C.I.A.A.C.; and Mr. J. H. Watts, chairman of Cambrian Airways.

Mr. Kenneth Davies, chairman of the Welsh Advisory Council for Civil Aviation, emphasized in his speech the contribution made by Swansea Flying Club in the development of Fairwood Common as Swansea's airport. Mr. Johns disclosed that almost £500,000 had just been allocated for the expansion of airport facilities in Guernsey; Senator Krichefski pointed out that Jersey's 1956 total of more than 400,000 air passengers was greater than that of Manchester and Glasgow combined; and Mr. Watts said that Cambrian's services from Swansea would be increased according to traffic demand in future.

Located on the site of the wartime Fighter Command station, Fairwood Common, the airport has three runways of 1,450 yd, 1,050 yd, and 840 yd. The existing control tower has been modified to include passenger-reception and catering facilities and has been generally modernized. Ekco airfield approach-aid equipment is incorporated in the second-floor control room. The airport will be managed for Swansea Corporation by Cambrian Airways.

BREVITIES

THE Comet 3 development aircraft, G-ANLO, was demonstrated to K.L.M. at Schiphol Airport on June 1. The time taken from Hatfield was 45 minutes.

* * *

T.C.A. intend to make weather radar standard equipment on their Super Constellations. Conversion will take about nine months.

* * *

As from June 1 three of Sabena's twelve weekly transatlantic flights will be made in daylight. During the summer the airline is to organize a six-day helicopter tour of the Loire chateaux.

* * *

T.A.I. are to begin a regular service between Paris and Australia next month. Initially the terminal will be Brisbane, but the airline is expected to operate into Sydney towards the end of the year.

* * *

Bristol Corporation are to spend a further £300,000 on the development of Lulsgate Airport. The chairman of the airport committee has said that "we intend to develop our airport so that B.E.A. will be forced to take some measure of interest in it."

A Comet 4 fuselage was tested to ultimate landing load at Hatfield recently. A total load of 90 tons was applied forward and aft of the wing-root fittings and the test continued to destruction. Failure occurred, D.H. state, at almost exactly the design figure.

Tiger Club support was strong at the Elstree At Home on May 25, reported last week. The race for Tiger Moths on that occasion was won by D. Hartas in G-AOXS. The club's participation at Swansea on June 1 is noted in the first news item below.

CLUB AND GLIDING NEWS

SUPPORT from the Tiger Club and the British Parachute Club contributed to the success of the display organized by the Swansea and District Flying School and Club at the new Swansea Airport at Fairwood Common on Saturday last. The previous evening, a thoroughly enjoyable "air ball" had been held in the Brangwyn Hall of the civic centre, to begin the city's celebrations in connection with the official opening of the airport (reported on page 785).

Tying knots in the air with an Auster Aiglet has come to mean just one man, Ranald Porteous, and his individual display at Fairwood on Saturday was undoubtedly the most effective item on the programme. Manœuvres were neatly positioned along the runway, in spite of a tricky cross-wind. Precision aerobatics by Tiger Moth were nicely shown by C. A. Nepean Bishop, who made the most of his inverted-flight ability.

The group demonstrations included Tiger formation work by a sextet and a trio led by David Phillips, and a formation drop by four members of the British Parachute Club. These were Keith Fuller, Vic Bartlett, Yvonne Turner and Don Hughes, all of whom are instructors under training. Individual drops by G. D. Sykes and Jim Basnett (who jumped from 4,000ft with a 20-second delay) were also made. Last item on the programme was a three-lap race for five Tigers flown by Tony Oldham, Mike Odell, Miss M. McKellar, Ken Smith and Denis Hartas, in which Hartas came up from last to first, with Oldham runner-up in a particularly close finish. The flying programme over, except for the pleasure flights, commentator "Dumbo" Willans prepared for a ten-hour drive to Clacton where, the next day, one of his parachuting protegées, Miss Sue Burges, was to drop into the sea for the edification of the Variety Artists' Federation of Great Britain.

TWO popular Continental rallies planned for the week-end of June 15-16 are the tenth International Rally of Lower Normandy at Flers, and the fourth International Rally of the Zoute Aviation Club at Le Zoute, on the Belgian coast. Typically strong representation at the Flers Rally is expected from the Surrey Flying Club; while the first 60 entrants at Le Zoute will benefit from a reduced entrance fee.

TO avoid confusion between the Aero Club of Ireland and the Irish Aviation Club (respectively local and national organizations) the name of the former has been changed to Leinster Aero Club. As mentioned on page 759, this club is organizing the Whitsun week-end air displays at Weston Aerodrome, Leixlip, near Dublin, which is the club's home base.

ON the occasion of the National Air Races weekend (July 12-14), the Wolverhampton Aero Club is organizing an invitation air rally for British and Continental clubs, to take place on Sunday, July 14. Visitors are asked to land between 12 noon and 1.30 p.m. and will be entertained to lunch; further details from the club, at Wolverhampton Municipal Aerodrome.

VISITORS by air to Bognor Regis are welcome to use the private airfield owned by Lec Refrigeration, Ltd., which is now being extended. There is a north-south runway of 450 yd, and a northwest-southeast runway now being extended from 550 yd to 650 yd (by the end of June) and 800 yd (by the end of the year). No landing fee is charged for private aircraft; intending visitors should contact in advance the Lec pilot, Mr. George Farley, at Bognor Regis 2201 or 3585. The Lec sales organization is at present replacing its Gemini 3A with an Avro XIX, and is looking for an Aero Commander with which to replace the Avro.

EVENING lectures at the Field Studies Council course on *Weather and Flight*, July 3-10 at Preston Montford Hall (preliminary details of which were given in *Flight* of March 15), will be given by Lorne Welch (soaring), R. J. Murgatroyd (meteorological research flying), J. Barlee (soaring birds), G. L. Stollery (colour photography), R. C. Rainey (flight and migration of locusts) and by a member of the staff of the Fluid Motion Department, Manchester University. Resident instructors for the course, which is intended to explain the principles of cloud physics and air dynamics and to interpret the natural phenomena of weather and the artificial phenomena of flight, are R. S. Scorer, M.A., Ph.D. (Imperial College); C. E. Wallington, M.Sc. (Meteorological Office); and F. G. Irving, M.Eng. (Imperial College). Enquiries should be sent to The Warden, Preston Montford Field Centre, Montford Bridge, near Shrewsbury.

COMPETITION launches at this year's National Gliding Championships at Lasham will be by aero-tow. The main difference of organization compared with the 1955 Nationals is that the competitors this year will be divided into two leagues, each with its own tasks and marking. Saturday, July 27, will be a practice and reporting day; the Duke of Edinburgh will open the championships at briefing on Sunday, July 28; and the contest will end on Monday, August 5.

FROM Southend Municipal Air Centre and Flying School comes news that recent expansion of flying activities has necessitated an urgent search for new instructors.

(Left) at the East Anglian Flying Club, Ipswich: John Garrod, instructor Stanley Ward, Pamela Klein and Frank Waller, plus Autocrat.

(Below) at the British Parachute Club, Fair Oaks: Army parachutists whose hobby is parachuting, Pte. Keith Fuller, Sgt. Don Hughes and Staff Sgt. Michael Reilly.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

The British Industry and the Paris Show

"AN Industry Executive," writing in your issue of May 24, expresses himself very much in favour of the Paris Air Show. Without attempting to assess the value of participation, there are important factors which must be taken into account in considering this question.

The S.B.A.C., representing all the main aircraft, aero-engine and guided-weapon companies, as well as nearly 600 manufacturers of materials, instruments and accessories, naturally keeps this international biennial event well under review. The statement that the Society appears to consider the show to be unworthy of a joint British exhibit shows a lack of understanding of the Society's position in these matters; the S.B.A.C. is the servant of its members and exists to carry out their wishes. It cannot "lead the industry to the Paris Show" because it is the industry itself—through the committees which exist to give members free expression of their views—which settles the policy.

All British aircraft manufacturers would, of course, like to participate in every exhibition of importance everywhere. The reasons which make this impossible are obvious, and the industry must spread its resources to the best effect. Exhibitions and flying displays distract the industry's technical staff from pressing development work, and sales staff from direct and individual sales efforts, so that no company can really support more than a very few events each year.

The Paris Show is of a different character from the Society's Farnborough Flying Display and Exhibition; it is international, and it is very much designed to appeal to the general public. On the other hand, the Farnborough display is the British industry's own shop-window. Its aim is to attract customers to visit Great Britain, not only to see the display and exhibition—designed very much to meet the demands of those directly interested in the technical achievements of the industry—but also to enable serious talks to take place with members of the British industry and to make possible visits to our aircraft, aero-engine and equipment factories.

The ever-increasing attendance from overseas airline operators, air forces, government departments and other purchasers of aeronautical material who regularly accept our invitation to come to Great Britain lends support to the conviction that the arrangements at Farnborough meet the needs of our potential customers.

London, S.W.1. H. W. GOODINGE,
Assistant Director, the Society of British Aircraft Constructors.

MAY I be permitted through your columns to add to the extremely interesting remarks concerning the Salon Aeronautique in Paris by "An Industry Executive" in your issue of May 24?

As is so often the case, only part of the picture has been presented, because no account seems to have been taken of the French view. On this aspect I have particular information.

After the previous show (1955) it was evident that British representation was not as good as it could have been. In consequence, this company prepared a 5,000-word dossier setting out the case for better British representation at the next show (i.e., that now running). This document was formally presented to the syndicate which runs the Paris Salon, and in due course Mr. James Sutherland, managing director of this company, and myself were invited to Paris to discuss the matter personally with M. Granet, the commissioner-general.

In a long interview at the syndicate's offices, the case was fully explored; and we were encouraged to proceed to the next stage, which was a detailed and written exposition of how our plans could be brought to fruition. This scheme had, for example, the benefit of advice from such people as Harold Gillman of the F.A.I. (and for many years previously Secretary of the S.B.A.C.) and the then British Air Attaché. The French Embassy in London likewise showed considerable interest.

I should explain that a major point in our scheme was that it should be a truly British representation, i.e., that Canada, Australia, India, Pakistan, and others should participate—for the first time.

Such was the encouragement we received that we were emboldened to write to 100 of the 550 firms in the British aircraft industry an exploratory letter setting out the facts and the potential.

Alas! after several months of delay the French turned down the proposition. The chief grounds were quite practical—that there was insufficient room to accommodate more exhibitors. M. Granet, in most courteous terms, explained that the syndicate did not wish to offend "old patrons" (meaning those who had for many years previously displayed at the Salon) and as those old patrons had already absorbed the full quantum of space available it would be impossible to contemplate raising British representation to even 100 firms. Incidentally, of the original firms circularized, 28 who had never displayed in Paris before gave full initial support to the scheme.

The fact is that the French made a bad under-estimate of the aeronautical potential when they conceived their ambitious "glass-house" permanent display reservation at Le Bourget. That is now admitted; but their timorous approach owes not a little to the open scoffing by British interests when, in about 1949, the project was first mooted after the Grand Palais had proved quite inadequate.

One interesting point emerges: the French did not close the door on our scheme, but said that although the 1957 display was impossible for its operation full consideration would be given to the 1959 Salon.

Finally, it is surely unfair to criticize the S.B.A.C. The fact is the Farnborough show is the British sales effort, and the Society cannot be expected to diminish its own major effort in order to support a rival concern.

As the whole nature of aviation, especially military, may have changed by the 1959 Salon, we would be glad to put before interested British companies a modified scheme which would enable them to participate in Paris at that time, especially as regards the new developments which require static presentation.

London, W.1. B. J. HURREN,
Director of Public Relations, James Sutherland Publicity, Ltd.

Stringfellow's Experiments

WRITING in your Correspondence page for May 15, Capt. J. Laurence Pritchard questions Mr. J. M. Bruce's reference to the Stringfellow model flight of 1848. So far as I can see in the pamphlet on the *Lives and Work of Henson and Stringfellow*, 1956, there is nothing definitely disproving Stringfellow's success in 1848. Admittedly we have no detailed report of an eye witness. However, the account by Stringfellow's son in his pamphlet of 1892 bears the impress of truth and I know of no evidence which refutes his fairly detailed statement. Having regard to the power/weight ratio of Stringfellow's engines there is no reason to doubt the possibility of a model flight in a still atmosphere at that time.

As to the statement that we should not have heard about Stringfellow but for his association with Henson—this, of course, brings us into the territory of "ifs and buts." Stringfellow was a talented mechanician; this we know, and enough data exists to establish his lengthy interest in aeronautics—whether first inspired by Henson we are not certain. I see no reason to doubt his success in 1848 until some direct evidence to the contrary is presented.

London, S.W.2. F. R. PIKE.

Brooklands Old-timers—R.S.V.P.

IT is, I believe, fairly generally known that on Saturday, July 6, Lord Brabazon has kindly consented to unveil at Brooklands a Golden Jubilee Memorial to the history of the motor race track and aerodrome.

It would be of assistance to my committee in the work of preparing invitations if former and long-standing members of the Brooklands Flying Club could send me a postcard giving their names and addresses. I would also be pleased to hear from people who learned to fly at Brooklands in the old days prior to World War I, and also from other people who had lengthy personal association with the aerodrome.

It may well be that by the time we have prepared a full list of people with strong connections with the motoring and aviation activities at Brooklands we may have to resort to some kind of lucky dip to keep the attendance within the limits of what is today practicable, but at least we would like to know that all the right names "went into the hat."

Weybridge, Surrey. CHARLES GARDNER
Vickers-Armstrongs (Aircraft), Ltd.

The Wearin' o' the Green

MAY I point out that the Aer Lingus emblem is not a clover-leaf (issue of May 24, Civil Aviation, "Irish Majority") The insignia of this airline is a shamrock—Ireland's national emblem.

Dublin. J. O'D.

THE INDUSTRY

Gun Reamers Marketed

GUN reamers of the type developed by Short Brothers and Harland, Ltd., Belfast, for a new machining technique which the company recently announced, will shortly be available to the engineering industry. This follows an agreement which Shorts have concluded with Serco, Ltd., 387 City Road, London, E.C.1, for the marketing of a new tool to be known as the Short-Serco gun reamer.

In announcing the technique, Shorts described its successful application to the production of aircraft undercarriage components, wing-root fittings and rudder bars. It is a revival of the old-fashioned gun drill, used mainly for drilling gun barrels and other components requiring deep and extremely accurate bores.

The Short-Serco gun reamer has a single tungsten carbide-tipped cutting edge, supported radially by two stabilizing wear pads which ensure reaming to consistently accurate dimensions.

Diesel-powered Starter Trolleys

AIR-COOLED diesels made by Petters, Ltd., of Staines, are being extensively used in aircraft servicing and starter trolleys manufactured by Red Devon, Ltd., of Totnes. Advantages claimed for the two types made are low maintenance costs (due in a considerable degree to the small Petter engines) and the fact that the power available is sufficient for starting all types of turbojet and turboprop power units.

The first type is the Model 726, a four-wheeled aircraft starter trolley using an AVA 1 single-cylinder air-cooled diesel engine, a D.C. generator and high capacity batteries. A second type, the 800 unit—used by B.E.A., the M.T.C.A. and many overseas airlines—is similar to the 726 with the addition of three-wheeled steering, which gives greater manœuvrability. This model uses an AVA 2 engine.

Keeping Runways Clean

INCREASING attention is being given, both in this country and America, to the problem of keeping runways free of dirt and stray oddments which may cause serious damage if sucked into the intakes of jet aircraft.

It will be recalled that Zwicky, Ltd., of Slough, Bucks, demonstrated their prototype sweeper-collector on the runways of Farnborough last September. The machine is now in production, and is being made and sold exclusively for airport and airfield use.

Since an orthodox chassis was found to be unsuitable, development has centred on a special chassis with drive from the front axle, leaving maximum accommodation for the sweeper and hopper. A Ferguson engine with heavy-duty Ford gearbox made specially for the sweeper gives a running speed of 20 m.p.h.; 72,000 sq yd of runway can be swept in an hour. A separate Ferguson power unit is devoted solely to the operation of the sweeper/collector unit, which includes a water-sprinkling pump. Runway refuse of almost any type, including surface water, sand and fine dust, is collected partly by inertia and partly by suction. Capacity of the refuse container is 3½ cu yd. Both the main brush and the collecting brush are 10ft in width, and brush pressure and speed are controlled from the driver's seat.

Flight Simulators on the Road

LAST week, in an article entitled "Highway to the Air," we described the work of Dallas (Kingston), Ltd., in road-haulage of aircraft fuselages over long distances. Brief mention was also made of the transport of flight simulators, and it is now possible to record further details of this aspect of the company's work.

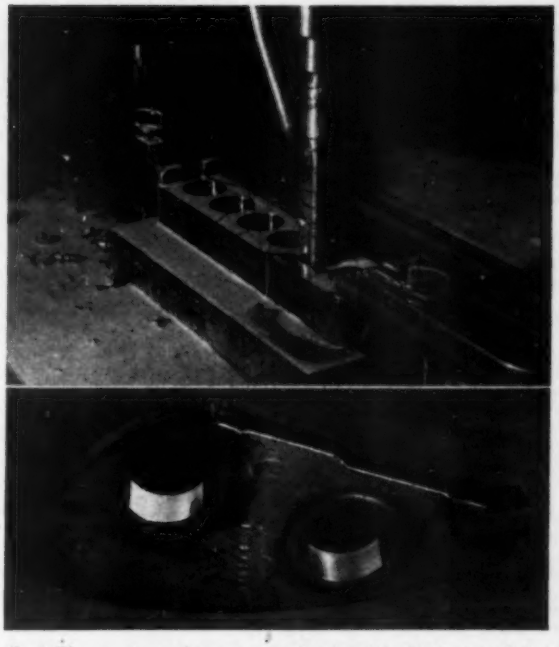
By its nature, electronic equipment of this kind calls for particular care in carriage and handling; a single installation, too, may require the use of a number of lorries.

A Britannia simulator for B.O.A.C., produced by Redifon, Ltd., at their Crawley, Sussex, works, was transported by Dallas from there to London Airport, where a formidable unloading job had to be tackled. The equipment was scheduled for installation on the fourth floor of the Corporation's headquarters building. As the internal lifts were too small for the major units, exterior scaffolding had to be erected to support a platform, to which the loads were lifted from the vehicles by a crane with an 80-ft jib. They were then moved into the building by Dallas's men in readiness for installation by the Redifon engineers.

Transport of a Gannet simulator to R.N. Station Eglinton, Northern Ireland (this particular equipment was illustrated in *Flight* for March 22) involved a journey from Crawley to Preston, Lancs, where the trailer was unhitched and shipped to Larne. There it was coupled to another tractor—English vehicles of this kind are excluded from Northern Ireland—and taken to Eglinton, where specially trained Dallas employees, who had accompanied it throughout, unloaded the equipment and placed it in position.

Other Redifon simulators, for Valiant aircraft, have been transported considerable distances for installation at R.A.F. stations. The units were completely encased in polythene, and further protected from the weather by tarpaulins.

"In each case," say Dallas, "we were congratulated on our methods and organization."



(Top) The new type of gun reamer developed by Shorts (see Col. 1) reaming holes of 1½in dia. in S65 (55-ton) steel at 600 r.p.m. and 0.008in/rev. feed. The long spiral of swarf indicates a successful reaming operation. (Lower picture) Forged component for an aircraft undercarriage, with holes reamed by the new Short method. Previously such holes had been bored—uneconomically—on a lathe faceplate.

Portable Battery Lighting Set

A LIGHTING set with breast battery, certified by the Ministry of Labour and National Service as intrinsically safe for use in inflammable atmospheres, is now available from the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. It was developed in collaboration with a large petroleum company and designed primarily for use where operations with fire explosion hazard, such as aircraft refuelling and maintenance, have to be carried out at night.

The equipment consists of a miner's-type lamp connected by a flexible cable to a separate battery container (waterproof, fire-resistant and impervious to oil or petrol), a webbing body harness, and a heavy-gauge elastic harness which will fit over any normal headgear or can be worn in any position on the body.

The lighting set is powered by three standard 1.5-volt cells; the total weight (including batteries) is just under 3½ lb; and the list price, complete with batteries, is £8 10s.

Mr. F. B. Hyde, who in his new post as co-director of the aviation division of Birfield Industries, Ltd., selling organization of the Birfield group of companies, will be jointly responsible with Mr. Eric Walker for sale co-ordination of all aviation activities within the group. His office is at the Birfield H.Q., at Stratford House, London, W.1.